



Marwood Canadian Headquarter

35 Spruce Street

Tillsonburg, Ontario, Canada

N4G 5C4

Phone: 1-519-688-1144

Toll Free: 1-877 MARWOOD (627-9663)

MARWOOD - DIE DESIGN GUIDELINES (JANUARY 2021)

Rev. 10 Updates identified in red

1.0: SCOPE

This document contains all guidelines pertaining to stamping dies built for and made by Marwood International. These guidelines are intended primarily for Approved Sub-Suppliers; otherwise referred to as “Vendors”.

1.1: Purpose

The purpose of these guidelines is to establish an acceptable die design standard to ensure the use of common purchased components and design methodology. The intent of this standardization is to increase overall efficiency by simplifying the set-up, running, and repair of tooling. The end product manufactured from the stamping tool shall prove to be capable of producing product, targeting nominal dimensional values repeatedly.

1.2: Deviation from This Standard

It is the responsibility of the Vendor to ensure the best tool manufacturing methods are adhered to at all times. In the event the Vendor wants to quote, design or build outside of this standard, a Die Design Deviation Request, (F0295) must be submitted to the Marwood Tooling Specialist. The request will be approved as appropriate and feedback provided to the Vendor from the Marwood Tooling Specialist. One form shall be submitted for each inquiry.

1.3: Review and Distribution

Marwood International will review these guidelines on a twelve (12) month minimum basis. A copy of this manual and all related documentation shall be readily accessible through the Marwood International data transfer service Sharefile.

2.0: CAD STANDARDS

2.1: File Extensions and Protocols

During quoting process Marwood CAD Department is authorized to convert .stp files to allow for quicker return on quotes. Once your company has been issued a LOI, Marwood is only authorized to send you the "native math data". Native Math Data is a term used by Marwood for customer issued CAD. Any error as a result of file conversion is the responsibility of the tool vendor regardless of the conversion source.

2.2: Who to Contact

If you are having issues with math data please contact your Tooling Specialist, who will put you in touch with Marwood CAD Data Management

OEM Customer	CAD Software Mandated	File Extension Used
General Motors	Siemens NX 11.0	.prt
Ford	Siemens NX 11.0	.prt
Fiat Chrysler Automobiles	Siemens NX 11.0	.prt
Toyota	CATIA V5 R25	.CATPart & .CATProduct
Subaru	CATIA V5 R25	.CATPart & .CATProduct
Hino	CATIA V5 R25	.CATPart & .CATProduct
Rivian	CATIA V5 R25	.CATPart & .CATProduct

3.0: QUOTATION

It is the responsibility of the Vendor to consider all of the elements identified in the Marwood Die Design Guidelines when estimating for quotation.

The following information must be provided in order for a quotation from a vendor to be considered:

- Part number and name
- EC level, GD&T level and drawing level
- Process description and parts per hit
- Lead time for delivery (FOB Marwood) of sample parts and quantity as per RFQ
- Lead time for date of tool completion
- Estimates of die size, blank size, and required tonnage
- Part and material specifications
- Confirmation of Marwood die specifications
- Any requests on the RFQ addressed
- Terms and conditions
- Exceptions
- One addition set of all punches and buttons
- Die sensors to be installed for the latch, anti buckle and cam return
- One set of spare punches and buttons are to be included in the quotation.

4.0: AWARD AND APPROVALS

4.1: Process Proposal

At the conclusion of the RFQ process Marwood will notify the successful supplier with a Letter of Intent/Statement of work (F0359). This LOI/SOW will indicate all requirements for timing and sample part expectations. It is the responsibility of the vendor to ensure that a signed copy of the LOI is returned to the Marwood Tooling Specialist. The LOI will be the indication to begin the Process Lay Out and Design Approval process. Only after the Tool Design is approved will a Purchase Order be issued. Material procurement and tool build timing begins when the PO is issued. A detailed timing plan must be forwarded to Marwood Tooling Specialist a maximum of 1 week from the receipt of the LOI.

4.2: Progress Report

It is the Vendor's responsibility to provide timing schedules and updates to the Tooling Specialist on a weekly basis. It is the responsibility of the vendor to submit tool reports to the Tooling Specialist no later than each corresponding Monday throughout the build process.

4.3: Process Approval

After a new tool (or EC revision to a current tool) has been awarded, the vendor will propose a process based on the quotation. This process proposal will consist of a strip layout for progressive dies, and/or a process layout for tandem transfer tooling. Please note that there are special requirements for Press Hardened Steel (PHS) Tools. A full list of PHS specific design requirements can be found at the conclusion of this section.

Marwood expectation is that all vendors consider material utilization and process optimization when providing concept and design.

The Tooling Specialist may request revisions to process and tool design to accommodate these factors. Please note that while Marwood may recommend changes to process, it is the responsibility of the vendor to ensure that tooling provided is capable of producing quality product and rigid tooling. This process layout may be uploaded to Sharefile or personally brought to the Tooling Specialist for approval. Only after the process approval stage should design begin.

A copy of the signed process approval form will be issued to the vendor. This will be signed by members of the Marwood Engineering/Manufacturing/Tool Room. All process layouts are the property of Marwood and should not, in total or in part, be given to another company or duplicated without the written approval of Marwood.

4.4: Design

After Tooling Specialist has approved the proposed process, then the die design can proceed. The die design approval process may result in numerous meetings between the Vendor and the Marwood Tooling Specialist, QA and Tool Room. The final die design review must take place at Marwood or via online hosting software (Web Ex), using the cross functional team identified. Approval of design does not absolve vendor of responsibility to provide reliable and functional tooling. Changes made to tooling after design approval must be communicated to Tooling Specialist, and the changes must be updated in the design immediately.

Upon approval of the design, the vendor must submit a copy of the 3D tool design to Marwood for archiving and quick reference throughout the build process. These should be submitted within five (5) working days of design approval to facilitate any further discussions regarding the tooling. This design must be separated by a minimum of 3 layers (1.Upper Die, 2.Lower Die, 3.Strip). The use of .STP file type should be avoided. Please consult with Marwood Tooling Specialist and CAD department for allowable file types.

All tools must be built to accommodate maximum and minimum material conditions, this applies to both geometric and physical properties. In order to maximize the efficiency of the design review meeting the following information is to be forwarded to Marwood Stamping Tool Specialist prior to requesting a review:

Adjustable sections on forms critical to GD&T

4.5: Simulation and Thinning

The maximum amount of material thinning allowed during conventional forming or drawing must not exceed **15%** of the material thickness or the maximum elongation specified in the material specification. For PHS tools the maximum material thinning to be considered is 15%. This is a minimum requirement; all precautions must be taken to ensure thinning is eliminated. The use of "Kiss" or Balancing Pads shall be used with provisions for adjustability. All sections must be capable of accepting the full specifications of the piece material (thickness and forming properties) without failure. It is suggested that simulations use the minimum and maximum material conditions. This is considered to be a guideline only, as the customer will retain full discretion as to the maximum(if any) thinning will be deemed acceptable.

All simulation results are regardless of tool type are to be reviewed with and posted to Marwood for retention and approval

5.0: Build Commencement

Once the Marwood cross functional team has approved the final design, the Vendor will be provided with an approved Stamping Tool Design & Buy-Off Sheet (F0392), signed by the Tooling Specialist. Only once the Vendor has received this approval and a Marwood Purchase Order may the build of tooling commence. This form must be signed by a member of the Marwood Tooling Specialist as well as the vendor. Any updates to the design must be discussed with the Tooling Specialist and an updated design provided upon the completion of the tool build. It is the responsibility of the vendor to ensure a signed copy of the process approval has been submitted, failure to return a signed copy will imply acceptance.

Approval of process by Marwood does not absolve the vendor from providing a reliable and capable process.

5.1: Final Approval

The criteria documented here must be deemed acceptable in order for final approval to be granted.

5.2: Tolerances

Each customer has its own master data that must be followed to obtain nominal targets (CAD Data/2D drawing). Nominal values are the ultimate goal to maintain repeatability within the specified tolerance. Any features that must be taken away from nominal must be discussed with and approved by Tooling Specialist. The Vendor is ultimately responsible for building tools that produce parts at **process** nominal and not print / data nominal.

5.3 Approval at Vendor Location

The Vendor will perform a full dimensional layout on six pieces (in free state) in accordance with the tolerances specified on the Marwood Quality Department (customer) supplied drawing. It is the responsibility of the vendor to ensure tools are producing parts as per the master data. All Parts must pass 100% the attribute checking fixture. Nominal Dimensional values are the target. Acceptance criterion is 1.67 PPK minimum. Vendor will submit this 6 piece sample, C.M.M. analysis, and the thinning analysis to Marwood. Vendor is required to provide equipment capable of running the tool as design intent.

Any discrepancies from the data to the checking aid must be reported to the Tooling Specialist. In the event parts produced are for modular assembly, assembly fit up will not be considered as replacement for fixture fit. All parts checked in fixtures are to be checked per the fixture instruction. The Vendor will complete a 30 piece capability study on any critical characteristics as identified by the drawing. Marwood will supply the vendor with up to 400 hits of material (the amount of material supplied will be in relation to product volume). Any further material required for the capability study will be the responsibility of the vendor to purchase

5.3 (Continued)

Tooling will be installed in the specified home press and a 300 piece minimum sample will be run. A SPC analysis of this sample will be performed to ensure capability. Any de-bugging, rework, modification, etc. required at this time will be the responsibility of tooling specialist to coordinate.

For PHS tools Marwood will do a thermal imaging scan after 30 hits to verify hot zones, spotting accuracy and water flow areas of concern.

A set of tooling will be certified as capable if all identified key characteristics satisfy a minimum PPK of 1.67 as run on Marwood Equipment. Tooling must be certified capable by Marwood before an invoice can be submitted, unless extenuating circumstances allow for other arrangements. These arrangements are to be made in writing to the Marwood Tooling Specialist, who will discuss with the internal program team.

A vendor's inability to provide the required production or inspection facilities at their own location does not relieve the vendor of such responsibility. The Vendor **must procure any necessary additional services from their own source** or Marwood can suggest an alternate. At no time is it implied that Marwood will perform the inspection on behalf of the vendor. Should the vendor wish to have this activity quoted by the Marwood Quality Department please contact the Tooling Specialist.

5.4: Approval at Marwood Location

The Vendor / Tooling Specialist must be present at Marwood International in the event the final approval which must be completed on site in the designated Marwood production press as per the Marwood SPPS. All of the criteria for approval at a vendor location must be met in order to facilitate the process of crossing the international border, Marwood will work to ensure all purchase orders state, "to include all technical support during buyoff at Marwood. " It will ultimately be the responsibility of the Vendor to ensure they are able to cross the border. Any de-bugging, rework, modification, etc. required at this time will be the responsibility of and performed by the Vendor.

All of the above applies to dies that are manufactured in Asia with the exception of the vendor support at Marwood. Marwood will support the first validation run which consists of process validation and part quality. Any minor quality adjustments required, Marwood will complete, however any major adjustment or process improvements that are needed, Marwood will out source the repair and costs will be charged back to the vendor.

In addition, the following documentation must be completed:

Workbook /Stamping Process Planning (F0392)

NAFTA – Certificate of Origin, (B232E)

Tooling will be installed in the specified home press and a 300 piece minimum sample will be run. A SPC analysis of this sample will be performed by Marwood.

6.0: SAFETY & ERGONOMICS

The safety and well-being of press operators is critical. They must be considered in all aspects of the tool design. Vendors will ensure that the required working height for the operator is addressed in order to provide the best ergonomic situation. The principles mentioned here are required as a minimum.

6.1: Guarding

All guarding must be painted yellow. Guarding must be present all around pinch points such as draw rings and floating sections. Guarding must conform to CSA Z432-04 and CSA Z142-09 as updated. Copies of these standards are available at www.csa.ca.

6.2: Noise Reduction

Use punch shear and urethane bumpers where applicable in order to eliminate excessive die noise and minimize reverse tonnage. All efforts must be taken to minimize reverse tonnage. The max reverse tonnage shall be no greater than 10% of the press tonnage.

6.3: Contractor Safety Program

The Marwood Contractor Safety Program must be complete prior to commencement of any on-site work. This is available for download from the Supplier Download section at www.marwoodinternational.com or from your Marwood contact.

6.4: WSIB Certification

All Vendors are required to have a current valid WSIB Certification on file **BEFORE** entering the premises. Regular renewals of that certificate should be emailed to WSIB@marwoodmetal.com. Under no circumstances should a Vendor perform work on Marwood premises without a valid certificate on file.

7.0: Punches, Pilots & Buttons

All punches and pilots must have die buttons. Where possible, only use non-headed buttons. In order to prevent the die buttons from pulling, they must be retained with keys, or screws and caps. All pilots must be 20° conical shaped (see Figure 21) and must be cleared through die sections, sub-plates and die sets in order to eliminate slug build up only use wire EDM through buttons with a 3/8 " land and 1/2° die taper is standard. Two screw Standard lifter style pilots

Pilots for use in PHS tooling shall utilize the longest possible length of angled lead, in order to assist in the location of heated blank. Upper pilot clearance shall be 1 material thickness per side as well the depth of the clearance hole should be maximum allowable.

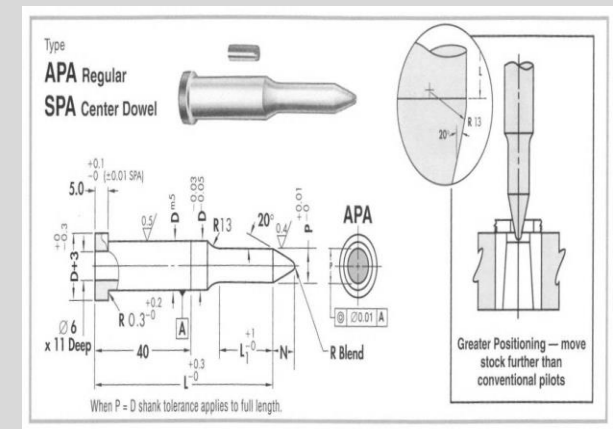
Figure 21: Pilot

All punches must be heavy duty type regardless if they are ball lock or headed
Ball lock holders must be heavy duty type

All punches and cutting sections must have spring loaded steel ejector pins.

Die Buttons must include a feature for slug retention to prevent " pulling ".

A minimum of 2 "shedders" must be placed around each pilot where possible the use of plunger style "Viler Screws" are NOT acceptable. Standard lifter style pilots are preferred. **Punch /trim entry must clear the lowest point of the trim land I.E (8mm land punch to enter 10mm)**



7.1: Stamps

ARGON Tool & Manufacturing stamps must be used when the part number is required to be stamped. Use stamp retainer and back plate set ARG-510 as indicated below (Fig 22) Marwood's suggested designs for implementing date stamps are quick-change block assembly styles. Some examples of these designs can be found below in **Figure 24**. Blocks must be designed unique in size from left to right hand to prevent incorrect installation. The stamp holders need error proofed as well to prevent incorrect loading

7.2: Cavities

The die process is required to allow to stamp components with the product number 'LH' and 'RH' as identified by the 3D data or product prints (IFPS). These stamps will be separate from Julian stamp holders, prevent mix of LH and RH. Please contact the Marwood Tooling Specialist for the specific stamp location on each part. In the event that a die has 2 or more cavities which produce the same part, these cavities must be identified. A good practice for identifying die cavities would be F & B, or L & R.

Figure 22: Stamp Holder Sets

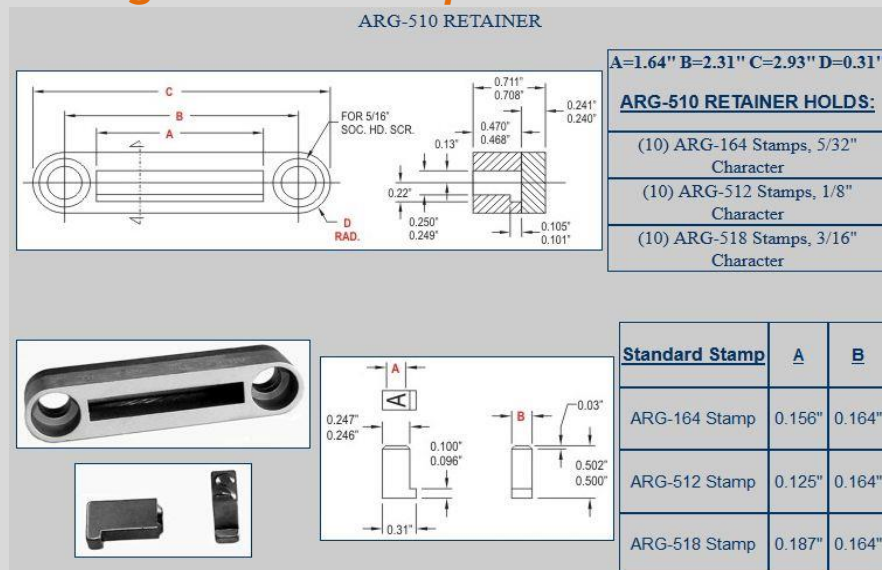
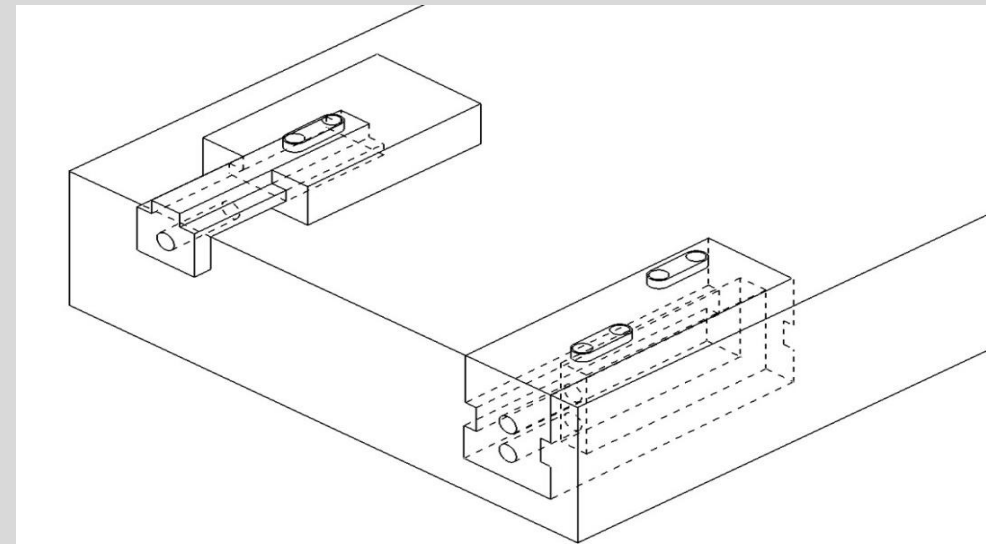


Figure 23: Stamp Quick Change Assemblies



7.3: Weld Projections

On occasion, Marwood Metal Fabrication will be required to resistance weld stamped components together. This may necessitate the need for weld projections to be formed in the die. The details provided here include basic dimensions for the geometry of the projections (**see Table 8**) as well as suggested punch types (**see Table 9**).

Table 8: Weld Projection Geometry

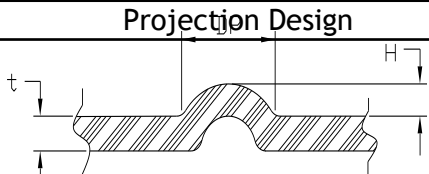
Projection Design		
		
t = thickness of thinnest outside piece (inches)	DP = base diameter of projection (inches)	H = height of projection (inches)
0.025	0.081	0.020
0.031	0.094	0.022
0.034	0.094	0.022
0.044	0.119	0.028
0.050	0.119	0.028
0.062	0.156	0.035
0.070	0.156	0.035
0.078	0.187	0.041
0.094	0.218	0.048
0.109	0.250	0.054
0.125	0.281	0.060
0.140	0.312	0.066
0.156	0.343	0.072
0.171	0.375	0.078
0.187	0.406	0.085
0.203	0.437	0.091

Table 9: Suggested Punch Types for Weld Projection Forming

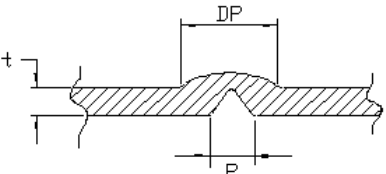
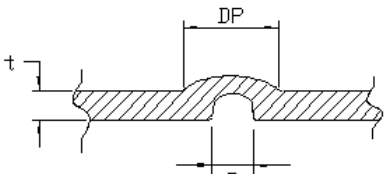
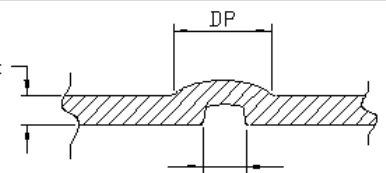
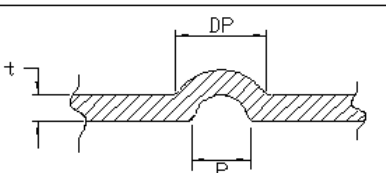
t = material thickness (inches)	P = suggested punch shape
0.150 0.100	
0.090 0.070	
0.060 0.050	
0.040 0.030	

Figure 17: General Motors Weld Nut Standard

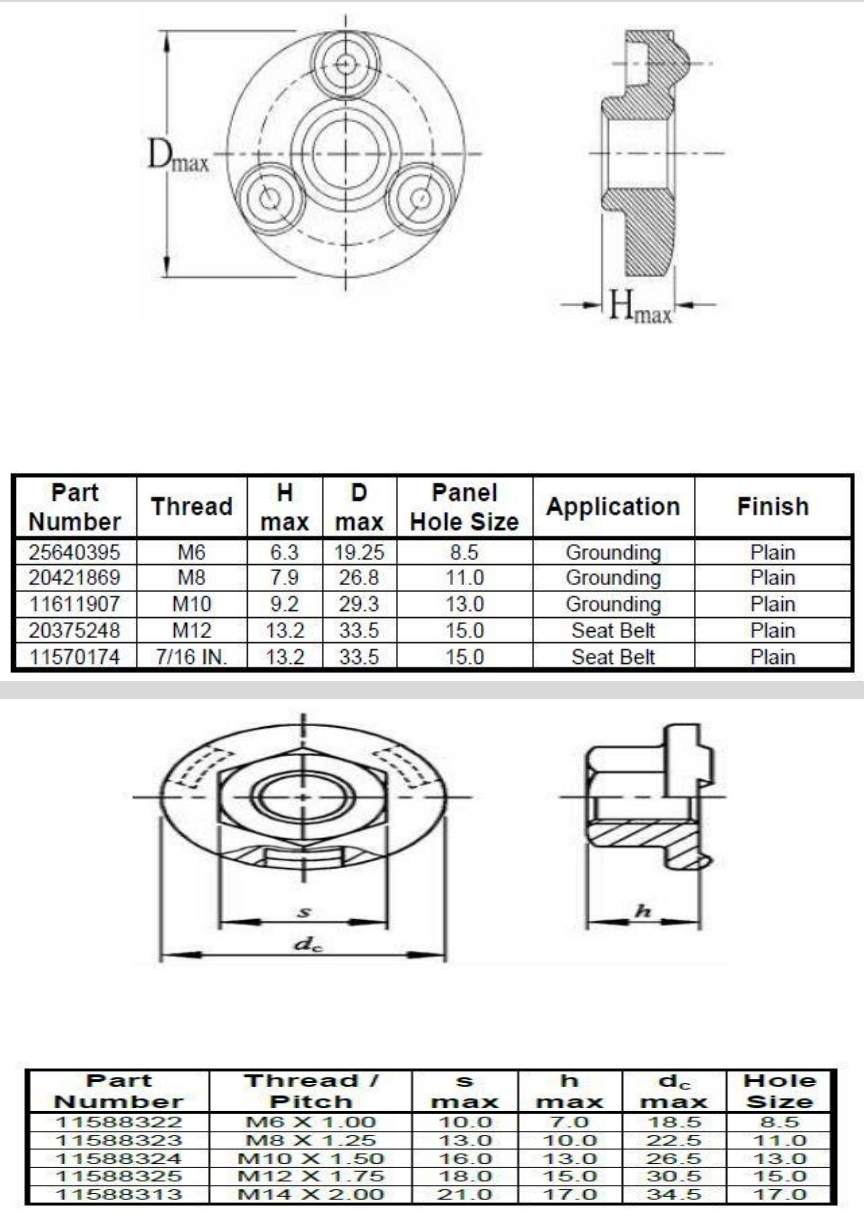
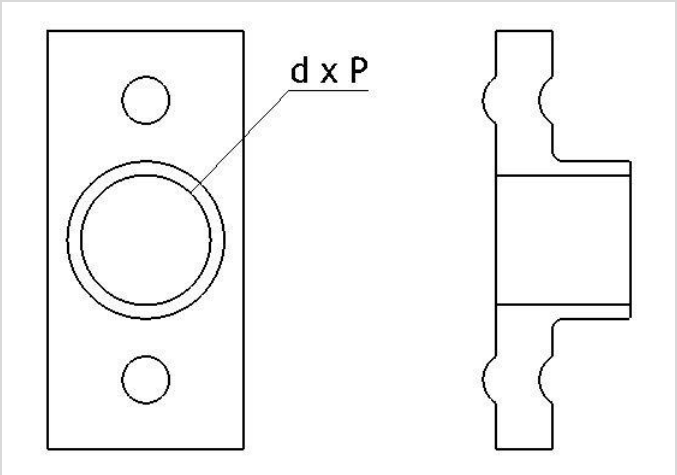


Figure 18: Subaru & Toyota Weld Nut Standard

Note: Hole diameter of the mating plate = $d + 1^{+0.3}$
Thickness of mating plate should be 0.6 to 3.2 mm

Nominal Size	Thread	
	d	P
4	4	0.7
5	5	0.8
6	6	1
'	8	1.25
10	10	



7.4: Springs and Cushions and Nitro Cylinders

Self-contained Nitrogen Springs must be used in place of coiled steel springs. If nitrogen is used in the top shoe, it must be contained or bolted in order to ensure the correct placement should a cylinder flatten during operation.

DADCO and Special Spring/Moeller are the preferred nitrogen cylinders. The stroke of the cylinders must not exceed 75% of the stroke. All pocketed cylinders / springs require vent holes. **Cylinders to be fixed body with only piston travelling**

The usage of coil springs must be approved the Tooling Specialist. If coiled steel springs are used then all spring deflections must be specified to maximum life. All springs must have spring retainer pins or "cans. " **Springs must never be cut to length**

If a cushion is required, use nitrogen and contact Tooling Specialist before procurement. Unless otherwise specified, use only DADCO or Special Spring/Moeller nitrogen systems. **Do not put preload on nitrogen cylinders (leave 0.020" clear).**

Where cushions are required in Progressive dies, all nitrogen cylinders must be plumbed to the console with sensor. All nitrogen plumbing shall be of the maximum diameter as specified by the manufacturer. Nitrogen must be plumbed to facilitate balanced charging, The vendor must incorporate a charge plate located near the console and clearly identify the recommended gas pressure required to make acceptable parts. For all draw dies the nitrogen pressure gauge must read in psi.

Where cushions are required on Transfer or Tandem (hand transfer) dies, is it the responsibility of the Vendor to contact the Marwood Tooling Specialist for discussion prior to the start of design. Consideration shall be given to presses that are using air cushions as outlined in the individual press specifications.

7.5: Ready Benders

Where rotary (ready) benders are used, the die must have “kiss blocks” installed. The height of these blocks will allow the die to produce parts to process nominal. When rotary (ready) benders are requested by Marwood, the vendor may use standard benders when the program volume is under 500,000. The vendor must use high volume benders where the program volume exceeds 500,000.

Adjustability must be incorporated to ensure the rotary bender can be adjusted to produce nominal parts through the allowable tolerance of the material. Adjustment must be designed for accessibility while in the press.

7.6: Quick die change

Although specific Quick Die Change techniques may be requested, the following are minimum requirements.

7.7: Clamping

Clamp surfaces shall be on centers with a 6” pitch (**see Figure 1**). The maximum distance between the clamping surfaces shall be 30” for the top shoe, and 36” for the lower shoe. The Marwood standard for die clamp surfaces of shoe, parallel, or sub-plate to the bolster will be as shown (**see Figure 2**).

The amount of clamping parallels on the lower die shoe needs to be a minimum of three, however this will need to be evaluated at the point of design.

In the event that the die shoe or a sub plate must be used, the clamping surface must be slotted to allow for the sufficient entry of the T-Bolt, Washer, and Nut as shown (**see Figure 4**). The slots must be ¼” wider than the nominal bolt size (**see Figure 5**). In order for dies to be clamped from the top surface down, all clamping surfaces on the parallels, or sub plates, must be machined or ground.

Where a set of dies must run in multiple Transfer or Tandem presses, they must all have the same storage height to allow ease of setup and clamping. For more press specific information, please refer back to Section 4, Press Specifications.

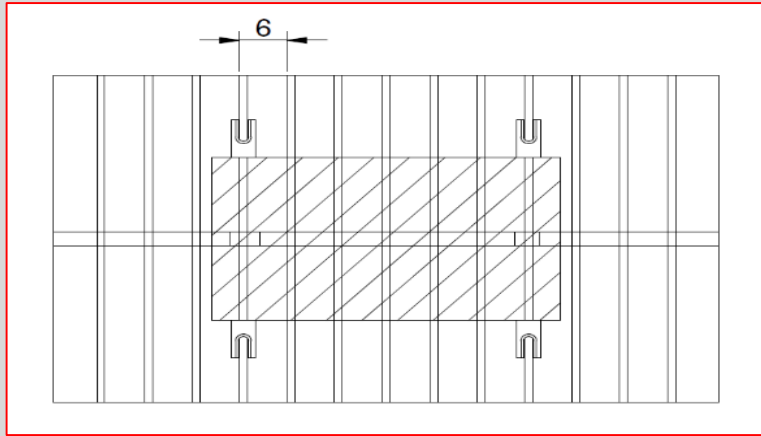
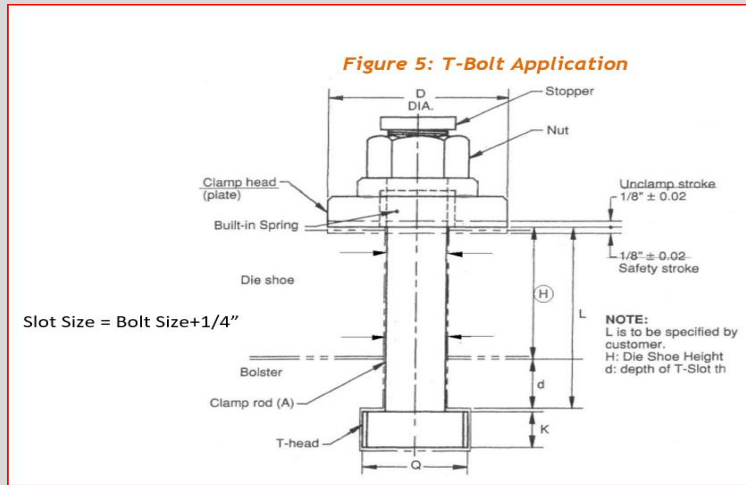
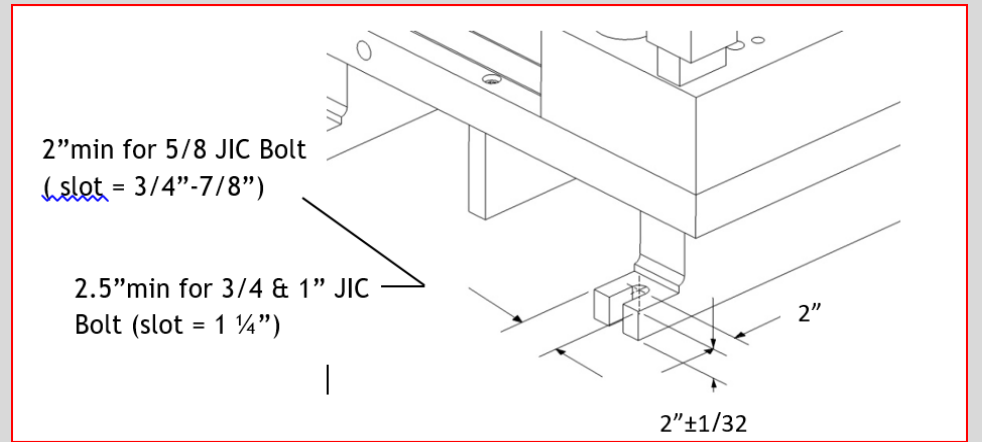
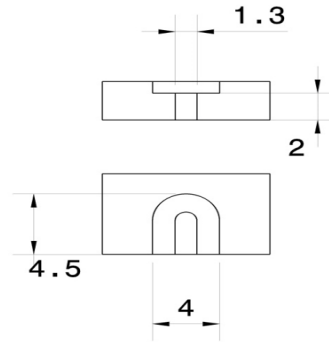
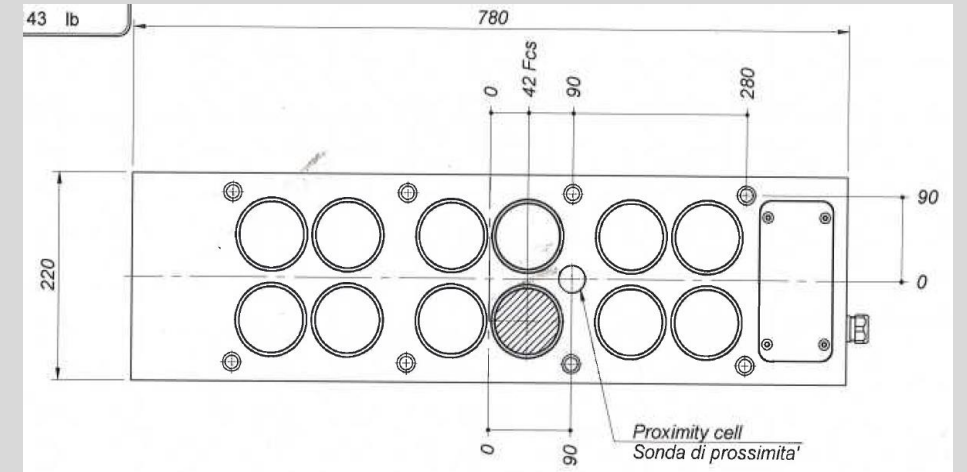
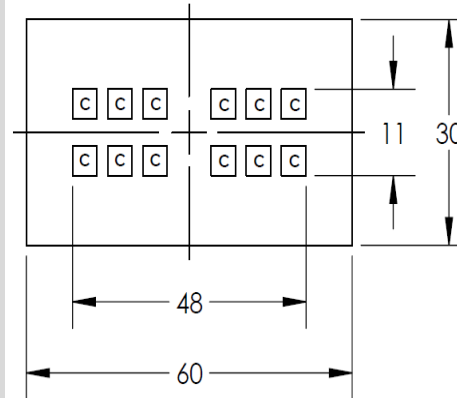


Figure 4: Slotted Clamping Surface



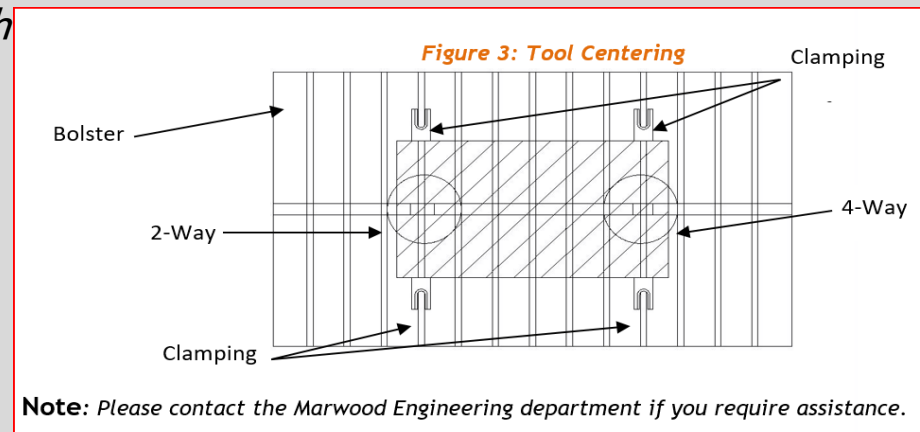
Magnet Layout: (C - Coil)



7.8: Centering System & Parallels

Marwood uses a centering system in all presses (**see Figure 3**). These components must always be located in the center of the strip layout (**see Drawings 2 & 5**). There are 2 types of centering systems; A and B. For these applications the parallels must have a minimum width of 3" and contain the centering inserts as outlined (**see Drawings 2–7**). These centering components will be located in the outside clamping parallels, as indicated, to facilitate accurate die location. In addition, the outside lower parallels will be doweled to the die shoe in order to provide the highest level of accuracy for the centering system. **The cone / round (4way locator to be on the in feed end of the die and the slot (2 way locator) to be on the outbound end of the die.**

In order to reduce the risk of injury to workers, all parallels must be bolted with a minimum of two 5/8"–UNC per side and with the proper weight to bolt integrity requirements. All bolts which fasten the parallels to the die shoe must be clearly identified and visible in open areas. In the event that it is not possible to locate a parallel mounting bolt in a clearly visible position, the bolts must be inaccessible until die sections are removed. For the safety of all workers, it is highly important that this condition be clearly identified on the die shoe. **Note:** *Please contact the Marwood Engineering department if you require assistance.*

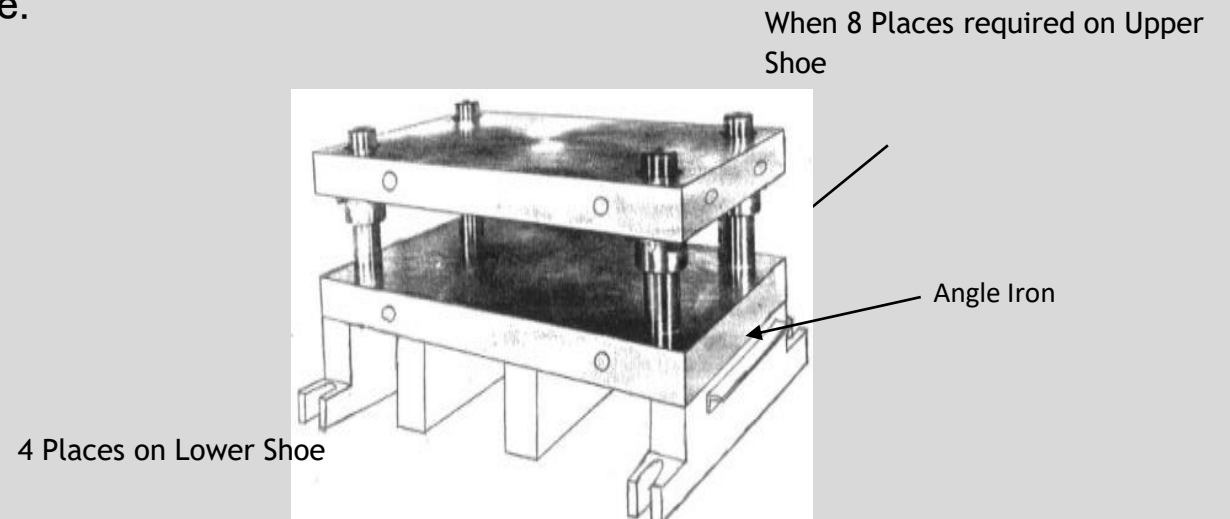


7.9: Die Sets

All die sets must have 4 threaded lifting holes on the top shoe, and 4 threaded lifting holes on the lower shoe. The holes should be placed along the die length with 2 on each face. If a die set is less than 32" in length, it must have 8 lifting holes drilled and tapped into the top shoe the additional hole will be placed in parallel faces along the width. All lifting holes must be positioned offset of parallels and stamped with the size information. Metric lifting holes will require painting dark blue as well as stamp identification. The size of the holes will be determined by the weight of the shoe (**see Table 5**). **NO COFFIN ARE TO BE USED TO LFIT THE DIE** While designing special attention must be paid to safe handling and loading with lift trucks. Actual Dimensions for Marwood Lift trucks are found on the next slide. Please note that there are actual dimensions and a minimum of 1" clearance should be accounted for in design. When the length of a die is less than 28", angle iron must be welded to the outside parallels for the purpose of lift truck handling (**see Figure 6**). For dies over 28" in length, there must be sufficient clearance between parallels to allow for lift truck access (**see Figure 7 and Table 3**). Max weight of die set is not to exceed the lifting capacity of lifting hole.

Table 5: Lifting Hole Size

Shoe Weight (lbs.)	(In)	(mm)
≤1,000	.500 (1/2)	12
1001 - 2000	.625 (5/8)	16
2001 - 4000	.750 (3/4)	20
4001 - 6000	1	*DO NOT USE 24mm*
6001 - 15 000	1.25 (1 1/4)	30

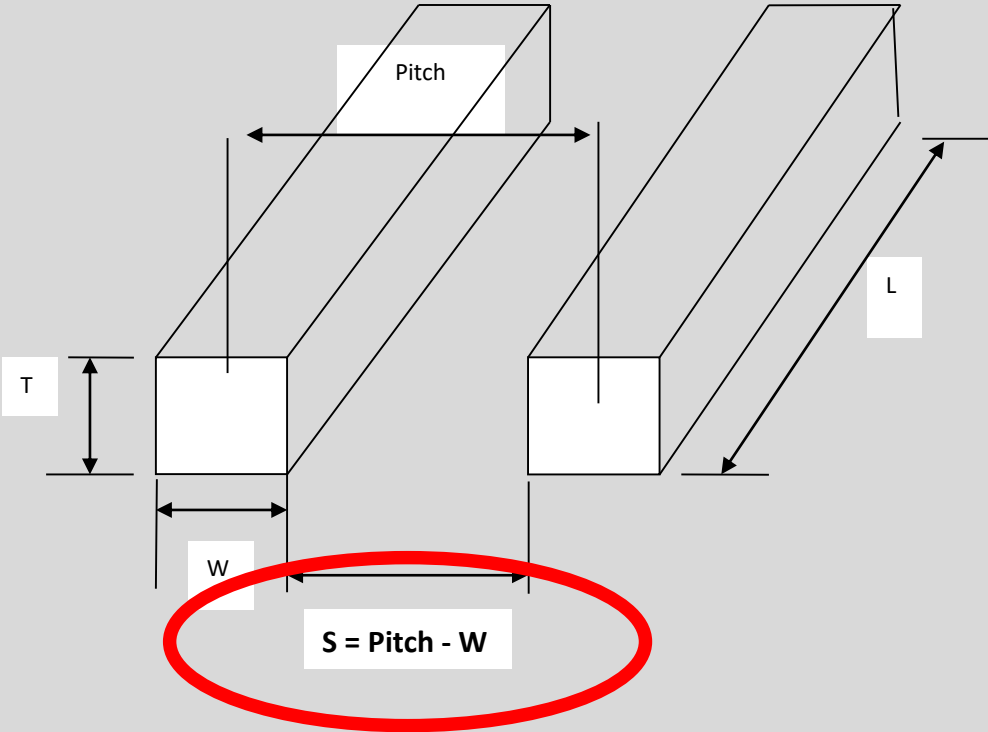


7.10: Lift Truck Dimensions

All dies must permit handling with a fork lift without damaging chutes, accessories or the die itself, fork position or locations must be clearly identified..

Manufacturer	Capacity	Fork width	Fork length	Fork thickness	Max opening	Fork pitch
Toyota	4400lbs	5"	48"	2"	31"	26"
Toyota	3620lbs	5"	48"	1 1/2"	31"	26"
Toyota	3620lbs	5"	48"	1 1/2"	31"	26"
Toyota	6250lbs	5"	48"	1 1/2"	36.5"	31.5"
Hoist	30000Lbs	7"	72"	3"	54	47"
Toyota	4400lbs	5"	42"	1 1/2"	31"	26"
Toyota	4400lbs	4"	42"	1 1/2"	31"	27"
Toyota	4400lbs	5"	42"	1 1/2"	31"	26"
Toyota	4400lbs	5"	42"	1 1/2"	31"	26"
Toyota	4400lbs	5"	42"	1 1/2"	31"	26"
Toyota	7700lbs	6"	42"	2"	40"	36"
Toyota	4800lbs	5"	48"	1 1/2"	31"	26"
Cat	14700Lbs	6"	47"	3"	48"	42"
Cat	15000lbs	6"	58"	2.5"	48"	42"
Hyster	10000lbs	6"	48"	2"	46"	40"
Heli	14330lbs	6"	48"	2.5"	67"	61"
Silent hoist	26000Lbs	7"	72"	3"	50"	43"
Toyota	3610lbs	4"	48"	1 1/2"	31"	37"
Toyota	4800lbs	4"	48"	1 1/2"	31"	37"
Toyota	4800lbs	4"	48"	1 1/2"	31"	37"
Toyota	6020lbs	5"	48"	2"	36.5"	31.5"
Toyota	4400lbs	5"	48"	2"	41"	36"
Toyota	4400lbs	5"	48"	2"	41"	36"
Toyota	3610lbs	5"	42"	1 1/2"	31"	26"
Toyota	3610lbs	5"	48"	2"	31"	26"
Toyota	3610lbs	5"	42"	1 1/2"	31"	26"
Toyota	4800lbs	5"	48"	2"	31"	26"
Toyota	3610lbs	5"	42"	1 1/2"	31"	26"
Toyota	3610lbs	5"	42"	1 1/2"	31"	26"
Toyota	3610lbs	5"	42"	1 1/2"	31"	26"
Toyota	4500 Lbs	5"	42"	1 1/2"	36.5"	31.5"

Figure 7 & Table 3: Lift Truck Fork Dimensions



7.11: Guide Pins

The guide pin diameter must equal the Anchor Lamina standard shown (**see Table 11**), where A and B represent the die Width and Length respectively. All progressive tools must have guide pins in the die holder (lower) and the bushing in the punch holder (upper). Most transfer and tandem (hand transfer) dies must have the guide pins mounted to the punch holder, and bushings mounted in the die holder. Die Pins and Bushings may be Misumi style provided they are appropriately sized. Dies with roller guide pins need to have a ability remove roller cage.

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7.12: Sub-Plates

The Tooling Specialist will specify when dies must be mounted to common sub plates. These sub plates may require special features for lift truck handling.

Note: *Please contact the Tooling Specialist for details.*

7.13: Storage

Transfer Dies must include provisions to equalize die heights for storage and QDC clamping.

Table 11: Anchor Lamina Die Pin Diameter

		B																																																
		10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82												
A	6	15	20	25	30	30	35																																6	A										
	8	25	30	30	35	40	45	50	55	60	65	70																											8											
	10	30	35	40	45	50	60	65	70	75	80	85	95	100	105	110	115	125	130	135	140	145	150	160	165	170	175	180	185	195	200	205	210	215	220	230	235	240	10											
	12		40	50	55	65	70	75	85	90	100	105	110	120	125	135	140	145	155	160	170	175	180	190	195	205	210	215	225	230	240	245	255	260	265	275	280	290	12											
	14			55	65	75	80	90	100	105	115	125	130	140	145	155	165	170	180	190	195	205	215	220	230	235	245	255	260	270	280	285	295	305	310	320	330	335	14											
	16				75	85	95	105	110	120	130	140	150	160	170	180	185	195	205	215	225	235	245	255	260	270	280	290	300	310	320	330	335	345	355	365	375	385	16											
	18	1 1/2" Pins				95	105	115	125	135	145	160	170	180	190	200	210	225	230	240	255	265	275	285	295	305	315	325	335	350	360	370	380	390	400	410	420	430	18											
	20					115	130	140	150	165	175	185	200	210	220	235	245	255	270	280	295	305	315	330	340	350	365	375	385	400	410	420	435	445	455	470		20												
	22						140	155	165	180	195	205	220	230	245	255	270	285	295	310	320	335	350	390	375	385	400	410	425	440	450	465	475	490	500	515		22												
	24							170	180	195	210	225	240	255	265	280	295	310	325	335	350	365	380	395	405	420	435	450	465	480	490	505	520	535	550	560		24												
	26	1 3/4" Pins								200	215	230	245	260	275	290	305	320	335	350	365	380	395	410	425	440	455	470	485	500	520	535	550	565	580	595	610		26											
	28										230	245	260	280	295	310	330	345	360	375	395	410	425	445	460	475	490	510	525	540	555	575	590	605	625	640		28												
	30											265	280	300	315	335	350	370	385	405	420	440	455	475	490	510	525	545	560	580	595	615	630	650	670	685		30												
	32												300	320	335	355	375	395	410	430	450	470	485	505	525	545	560	580	600	620	635	655	675	695	710	730		32												
	34	2" Pins												340	360	380	400	420	440	460	480	500	520	535	555	575	595	615	635	655	675	740	715	735	755		34													
	36															380	400	420	445	465	485	505	525	550	570	590	610	630	655	675	695	715	780	770	780	800		36												
38																	425	445	465	490	510	535	555	580	600	625	645	670	690	710	735	755	820	800	825		38													
40	Die space sizes are grouped by colour shading with suggested guide pin diameter.															470	490	515	540	560	585	610	630	655	680	705	725	750	775	795	860	845	865		40															
42																	515	540	565	590	615	640	665	690	715	740	760	785	810	835	900	885		42																
44																		565	595	620	645	670	695	720	745	775	800	825	850	875	945		44																	
46	Box Numbers indicate the approx. weight of a single plate 1" thick.														2 1/2" Pins				620	645	675	700	725	755	780	810	835	860	890	915		46																		
48																																																		48
50																																																		

7.14 Heeling Blocks

For any tool that has a primary press of 400 ton or larger, Corner Heeling Blocks are to be installed to increase stability. Any tool with "off balance " forming operations should also be considered for Heeling.

7.15: Cast Tools

Due to the complex nature of cast die construction, the Vendor must contact the Tooling Specialist for an extensive breakdown of design requirements. Casting Patterns shall be considered part of the tooling design, and must be submitted to the Marwood Tooling Specialist .

Cast die sets must contain the following:

- G2500/NAAMS cast or equivalent.

- Castings construction: Outside wall to be 1 ¼" thick minimum. Inside wall to be 1.0" thick minimum. The casting must be built with sufficient strength to perform robustly during the life of the tool.

- Drain holes must be included in any area where water or coolant can collect.

- Die handling must be determined at design review (mushroom cap, removable, etc.). Distance from lug to casting is to be more than 2" to accommodate lifting hooks. Should handling lugs be removable, all 8 are to be shipped with the die.

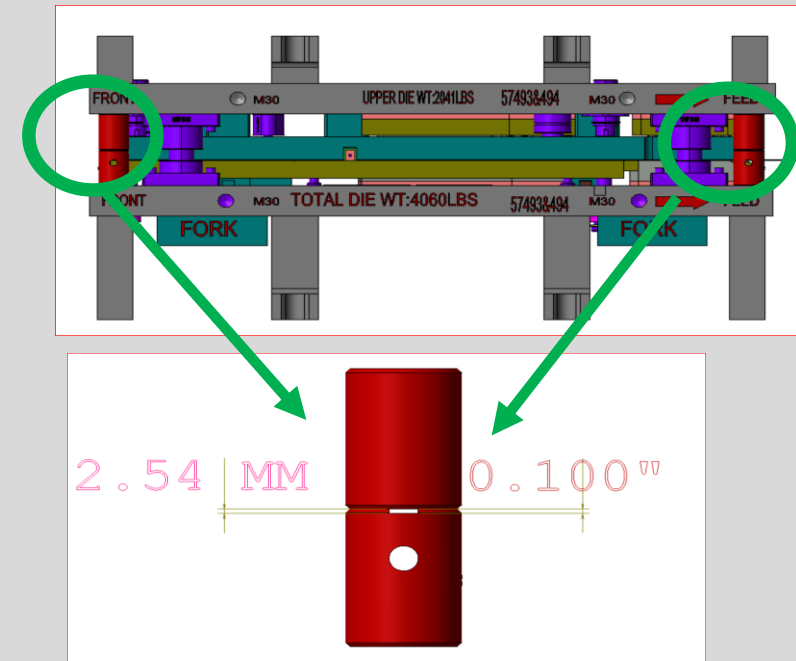
7.16: Shut Height Control

All Dies will utilize a lead check groove to verify shut height at set up. In all cases the combination of the lead check groove and lead reading will equal out to .100". Shut height control blocks must always be located over a parallel and be bolted through with a cap screw.

Shut height control blocks (Kiss Blocks)

Kiss Blocks must be painted red. All dies that use rotary or ready benders must use kiss blocks. These must have a groove 0.500" wide by 0.100" deep in the top surface. All blocks shall have a minimum diameter of 2". A .500" hole shall be present for the purpose of detecting an 'over hit' condition. Please refer to the stop block geometry for any clarification. Kiss blocks may be required in other applications as well.

Note: *Please Contact the Marwood Tooling Specialist for details*



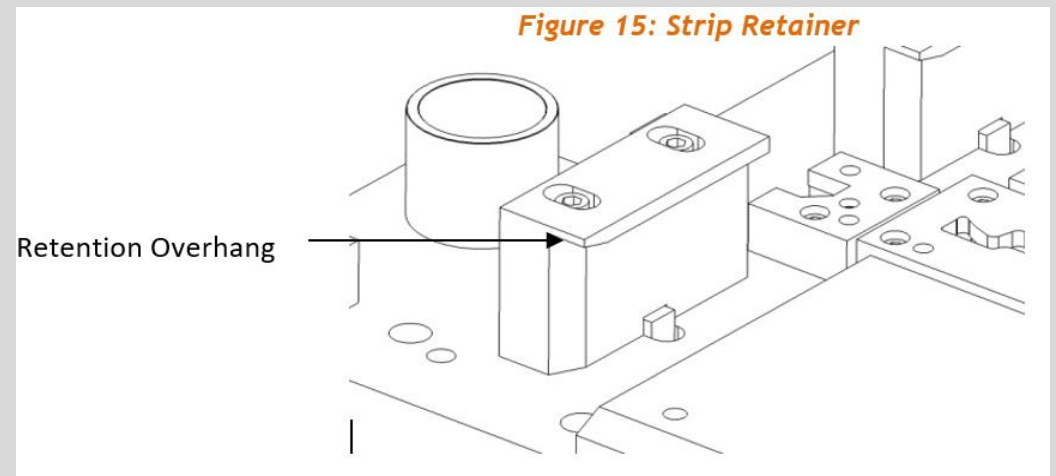
Contact Blocks "Kiss Block"

7.17: Stock Guides

All stock guides must be hardened and their surfaces ground. They shall have a minimum length of 10" on the fixed side and a minimum length of 8" on the adjustable side. If the press or die size does not accommodate this, alternate arrangements will need to be approved by the Tooling Specialist.

Progressive dies shall have provisions in place for ensuring strip straightness at set up, for example added pins along top of stock guides to help alignment of strip during set up

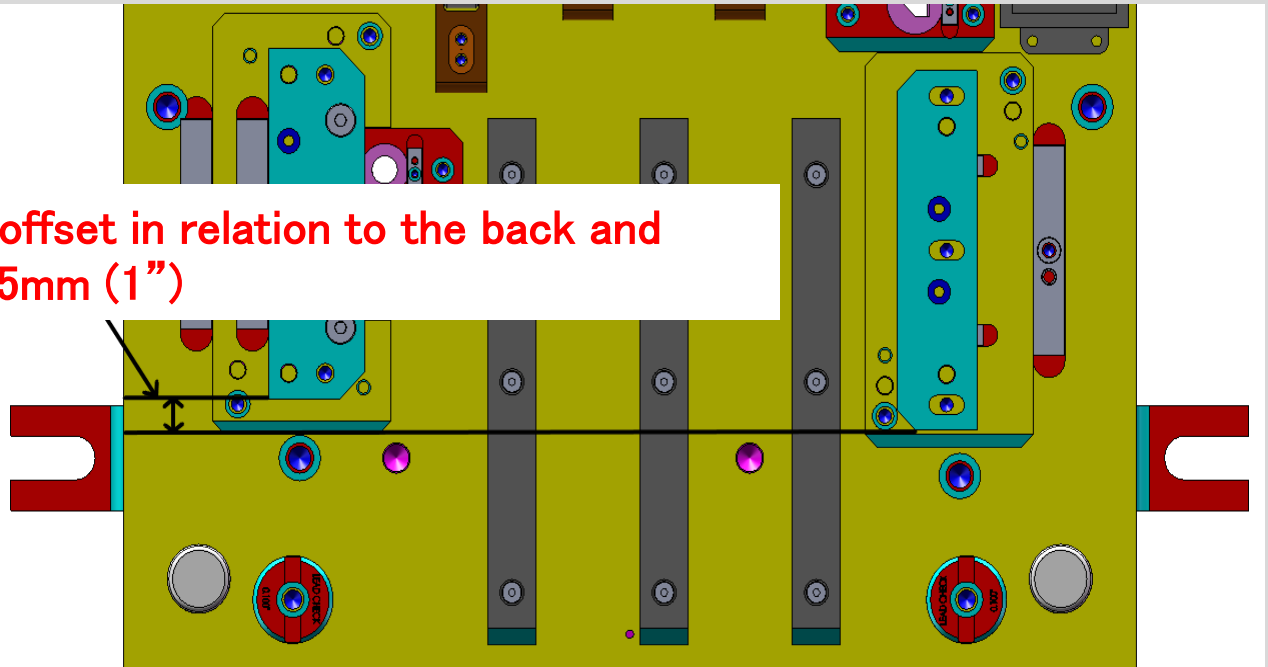
All guides must use strip retention overhangs in order to prevent the strip from lifting out of die (see **Figure 15**). The material entry point of all guides must be angled and radiuses to facilitate set up. All guides must have pry slots on the bottom in order to allow for easy removal inside the press. If fringe cuts are required, notch must be cut at the same time as pilots are pierced.



7.17: Stock Guides Continue

The front guide must not be adjustable, all adjustable guides are located on backside of the die and must be able to allow for the required material width tolerance specified by Marwood's customer (as per Marwood SPPS). **The stock guides to be off set in relation to the back and front guide.** The adjustable guides must always be keyed so they can only move in one direction, parallel to strip. These adjustable stock guides must be doweled to meet the material width at nominal (as per Marwood SPPS). The strip start location must be clearly identified on the top of all guides.

The stock guides to be offset in relation to the back and front guide. Offset of 25mm (1")



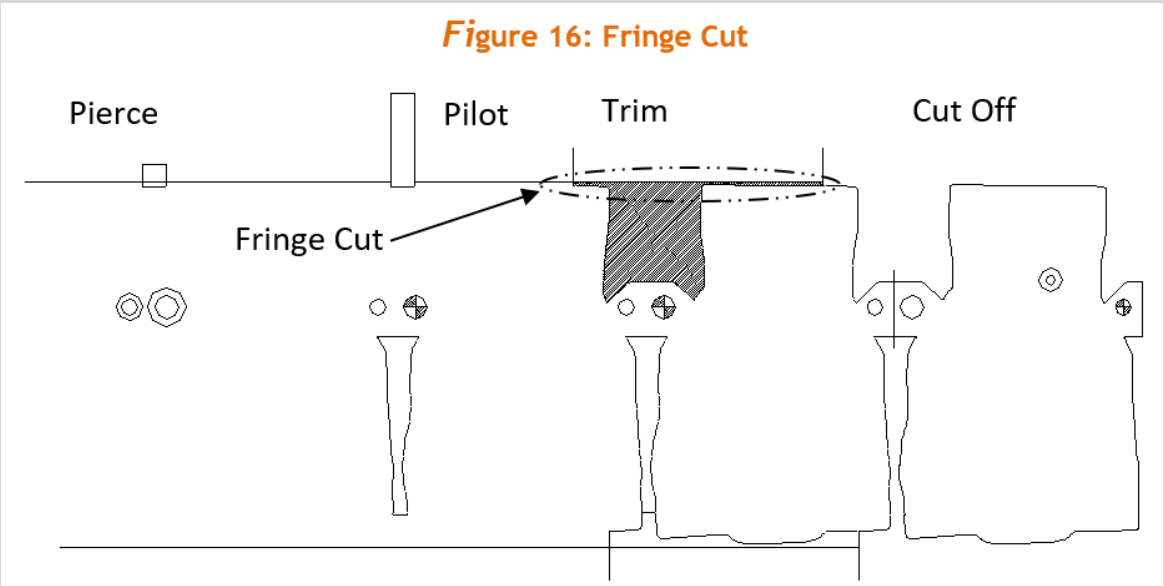
7.18: Progression Control

In order to facilitate better progression control the use of a fringe cut is recommended (see Figure 16). This must be addressed with the Tooling Specialist during the design phase. When material is 20”(508mm) or wider, notch The latch assembly must extend over the top face of the sensor block. Where possible, the Light Assist Spring must be internal. The “Latch” must have a minimum ¼” (6mm) threaded hole in the back face. The use of a notch and latch is standard on all progressive dies to check for complete feed and over feed. The use of a Marwood standard size notch punch and button are required for the fringe cut.

The latch assembly will be mounted on a fixed rail on the operator side of the die, the assembly must extend over the top face of a Marwood standard sensor block. (light assist Spring (1/4” dia.) for return)

The following guidelines have been provided (see table)..

Material Type	Material Thickness	Fringe Cut Depth
Steel	0.047in & up	1.5x material thickness
	>0.047in	Contact Marwood Engineering
Other	All	



7.19: Carrier Guidance

The use of Carrier Guidance (see Figure 19 & 20) is recommended for all Marwood Dies. This shall be discussed with Marwood Engineering during the concept review.

7.20: Lift and Lifters

Lift "MUST" be considered in the die design (Strip lift to be kept as low as absolutely possible) and will be reviewed by the Marwood team. In order to eliminate any interference when feeding material through the die, use spring loaded steel stock lifters ahead of cutting sections. Non-rotating bar-type lifters are recommended. The use of standard lifter products is preferred wherever possible. Any lift element that could become disengaged from its adjacent sections must have an anti rotation feature to prevent damage in case of breakage

Figure 19: Formed Tab Carrier Guide on Lifter Bar

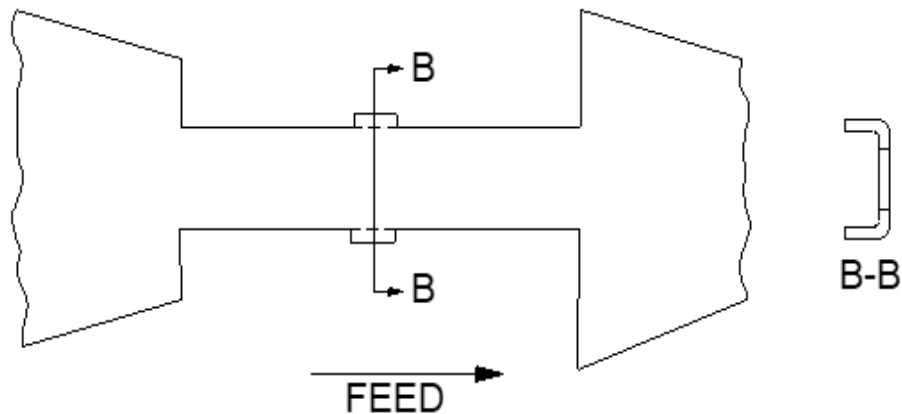
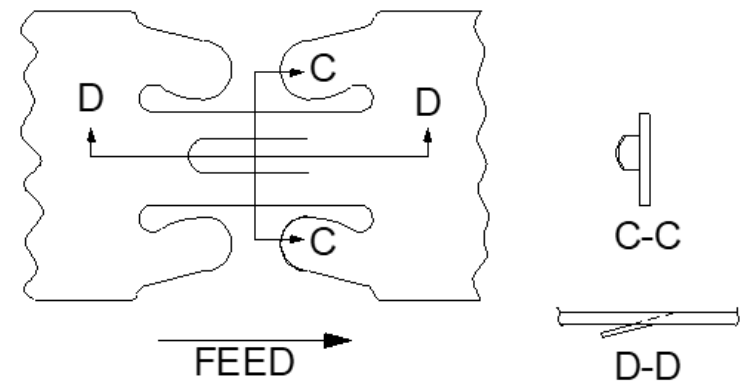


Figure 20: Lanced Tab Carrier Guide on Grooved Lifter Bar



7.21: Pockets & Drain Holes

Any pocket in the lower shoe must have drain holes in order to allow the stamping oil to drain. Some application examples include: nitrogen cylinders, coil springs, and sensor slots.

7.22: Lubricants

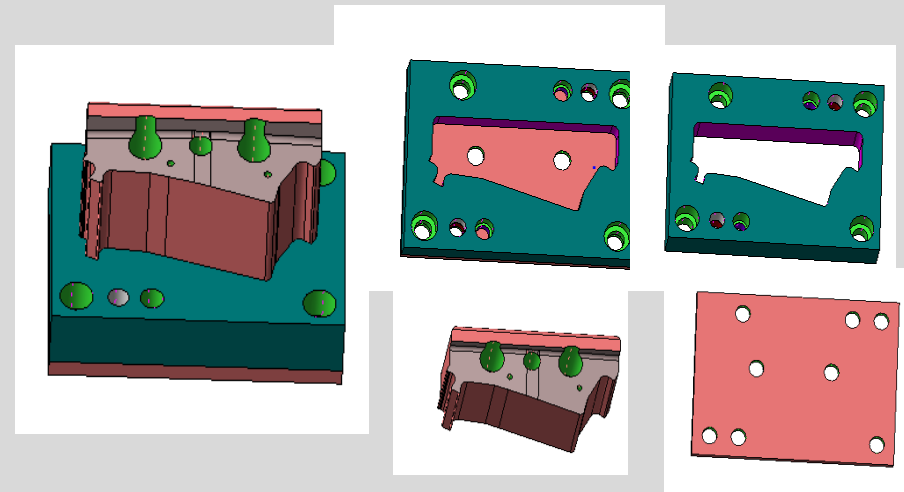
Dies must be designed to require no lubricate during operation. All exceptions will need to be approved by Marwood Engineering. Where draw lubricants are required please contact the Marwood Engineering department for a complete list of approved oils. Marwood Metal Fabrication will supply the appropriate lubricants for the purpose of development and buyoff.

The most commonly used lubricant at Marwood is Fuchs Montgomery DB 4265 C.

7.23: Pocket die steels

Wire cut punches in holders only in gut stations of progressive dies.

Punch /trim entry must clear the lowest point of the trim land I.E (8mm land punch to enter 10mm)



7.23: Tool Steel

Identify all tool steel by stamping the respective type (A2, D2, etc.) Use Marwood preferred cutting steels (see **Table 6**) where appropriate. The preferred material for form sections is D2 or equivalent. For PHS tools Use P20 steel for forms on low volume tools (100K or less annually). Flame harden working surfaces to 55HRc. High wear areas and higher volume tools should use H-13 (Over Supreme) material, hardening this material type to 46–48 HRC.

Other types of tool steel will be considered by Tooling Specialist if an extreme wear situation is present (i.e. dual phase, trip steel) or if the volume is substantially high and can be communicated before quoting and construction.

Should variance be required, the selected tool steel should be suitable to the part material and application. All efforts must be taken with moving sections to avoid steel against steel contact, where possible bronze inserts impregnated with graphite should be utilized, should a steel on steel condition be unavoidable they must be sufficient provisions for lubrication “grease” grooves along the entire wear face.

All areas of high wear concern **E,G, UPPER FORM BLOCKS WHERE A WIPE/DRAW CONDITION IS PRESENT** should be designed using as small form steel section as feasible. These steels will NEED TO BE be hard coated.

Note: *Contact the Tooling Specialist for details.*

Table 6: Preferred Cutting Steel

Material Thickness (mm)	Type
≤0.8	D2/SKD11
>0.8	A2/DC53

7.24: Sections

No die section shall exceed 12” x 12” x 4”.

Any die section with a weight of more than 25lbs must have threaded provisions for safe lifting.

All fixed sections must be doweled.

All pocketed/heeled sections must have threaded jacking holes in order to ease the removal off of the dowels or out of the pockets.

The use of pull dowels.

All sections for wiping or bending shall extend past the tangent point

All counter bored holes in serviceable sections to be at a depth that allows for maximum service life.

It is the responsibility of the Vendor to ensure that none of the die sections are interchangeable. The Vendor must also ensure that none of the sections can be installed in the wrong location. A common error proofing technique is to offset the screw holes.

All die sections must be screwed and doweled (welding is not permitted). Large sections must be ground with shear in order to reduce noise and shock during cutting. Shear requirements will be determined by material thickness (see Table 10).

Table 10: Shear Requirements

Material Thickness	Minimum Shear on Punch
1.2 mm and under	Material Thickness
Over 1.2mm	Half Material Thickness

7.25: Welded Sections & Trim Steels

It is important that all precautions are taken to avoid welded sections. In the event that this is the only solution, the condition must be reported to the Tooling Specialist. It shall be at the discretion of Marwood to use or replace the component in question. Welded trim steels will not be accepted without written permission from the Tooling Specialist.

7.26: Cams

All cams must use a positive return which will be discussed at Die Design Review. Provisions shall be in place to sense that the cam has reached its "home" position as a requirement of the Die Sensoring program. External cam return springs are not recommended. In the event that it is necessary, they must be guarded and contained. Please refer back to Section 6.0 Safety & Ergonomics, for additional guarding requirements.

7.27: Strippers

All strippers must have milled windows to allow for ball lock punch and pilot access/removal, this includes access for the punch removal tool. Stripper windows should be machined with .003" clearance to their pocket to allow for easy removal. Strippers on all piercing and cutting punches must be mechanically spring loaded. **If Moeller True-Strip units are required we will discuss at design review.**

7.28: Scrap

No scrap piece shall be larger than 12" in length or width. If this is necessary, scrap cutters must be incorporated.

All precaution should be taken to ensure that there is no scrap remaining in die upon initial feeding of material. Should the start position of the coil allow for scrap to remain on any portion of the tool while conducting the initial loading process, it is necessary to have said scrap fastened to the front face of the die shoe, painted in contrast to the color of the tool. This signals the operator to remove said scrap manually. If the scrap must exit the die in a location that is over a parallel, this parallel must be angle cut (**see Figure 13**) to allow the scrap to reach the shuffle chute.

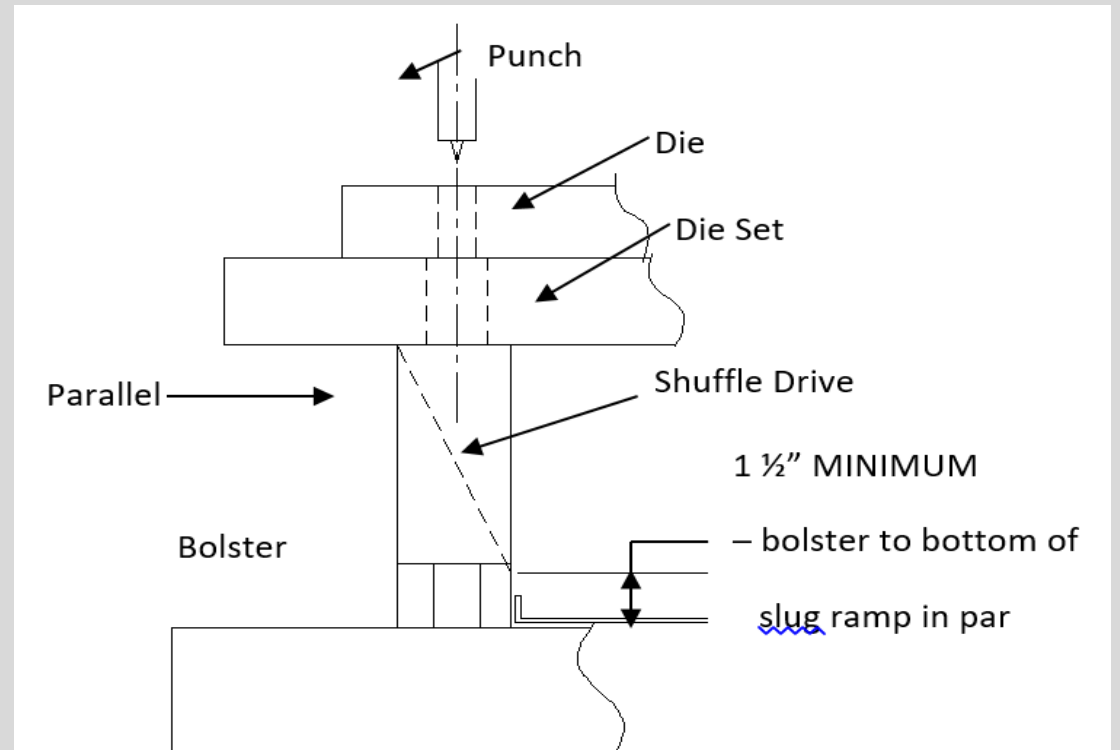
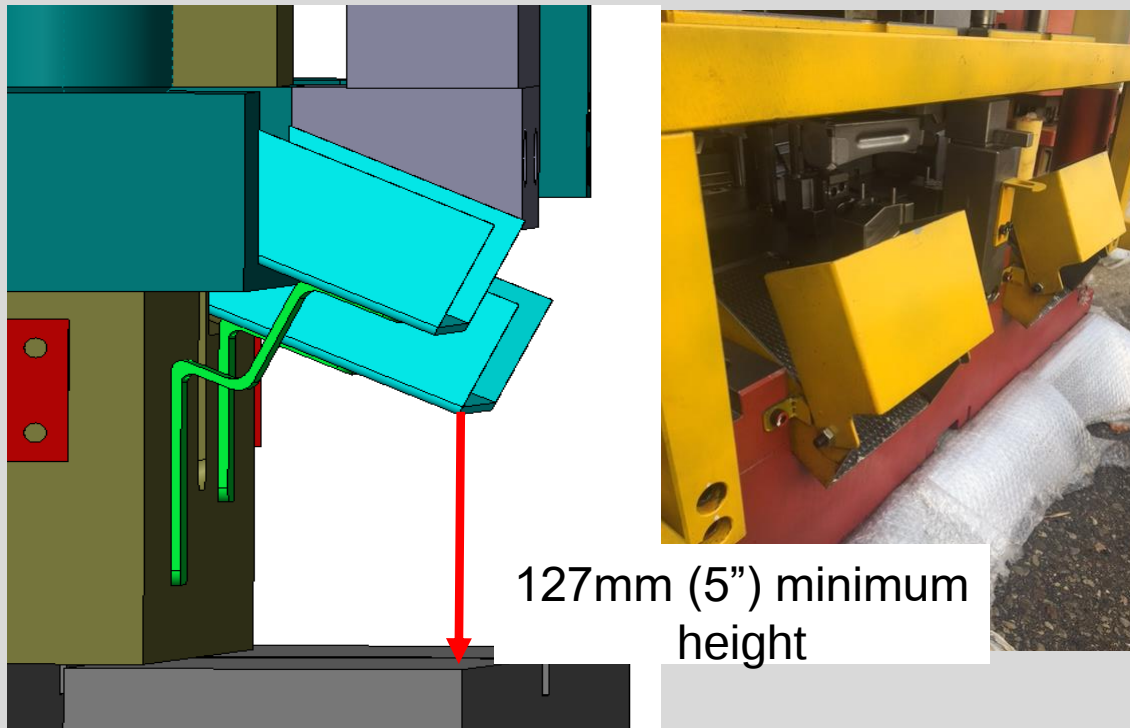
Where cutting locations must overlap on finished product, bypass notches or "cookie bites" must be used to ensure no burring on the product occurs. It is the Vendor's responsibility to propose and incorporate these in the die design.

Part Eject Chutes

All chutes which are contained within the die must have a minimum gauge of 4mm and shall be built of substantial material in order to deter premature maintenance (Dimpled Steel is preferred). They must also be appropriately guarded to prevent the risk of damage from lift truck forks. A chute bracket (see **Drawing 9**) must be included where chutes are used for scrap or part removal at the end of the die.

Where ever possible the end of part ejection chute should be at a height of 127mm (5") from the top of the bolster to the lowest point of the part ejection chute. The part chute to have a hinged section which will allow the chute extend over the conveyor.

Figure 13: Slug Ramp Detail



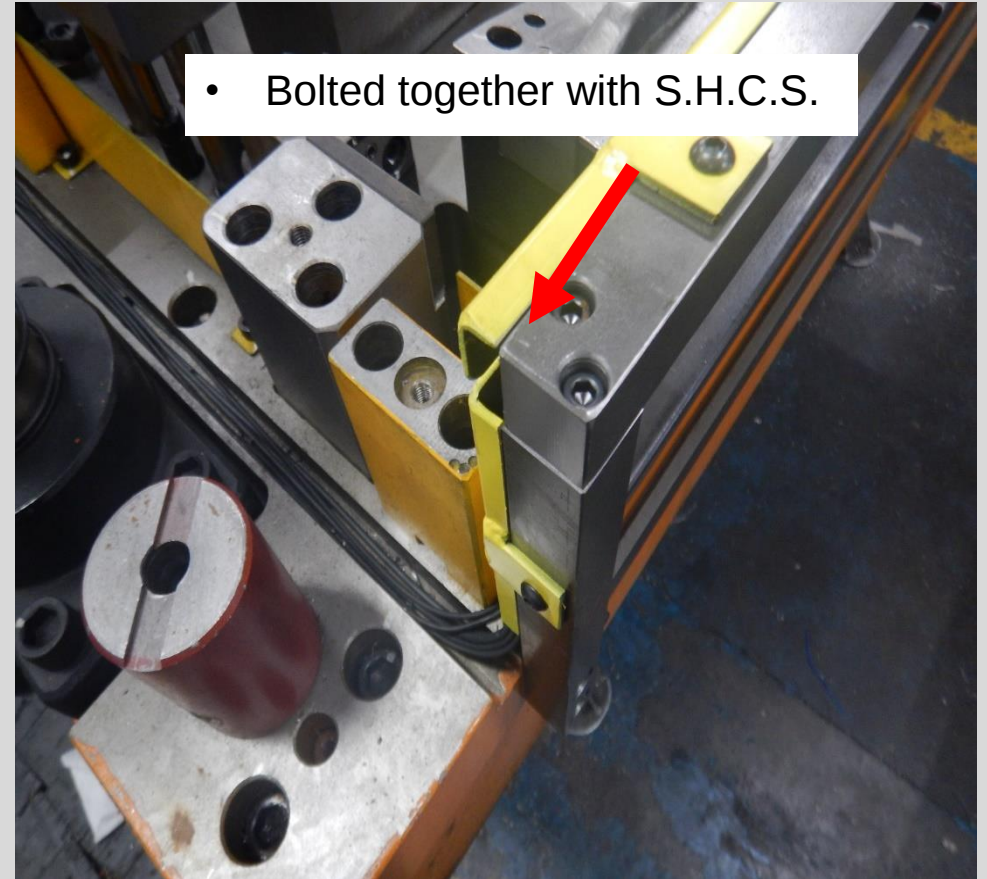
Towel Bar for Part Ejection Sensor Mounting

Spacer update towel bar drawing
to include spacer



Towel Bar for Part Ejection Sensor Mounting

- Bolted together with S.H.C.S.



Towel Bar for Part Ejection Sensor Mounting

- Add 3/8 to 1/2 spacer on each side between bar and die shoe
- This is clearance for the top die shoe
- Must be bolted on



Towel Bar for Part Ejection Sensor Mounting

- Bolted on the die shoe with two S.H.C.S
- Use 1" pitch on smaller die shoes if necessary



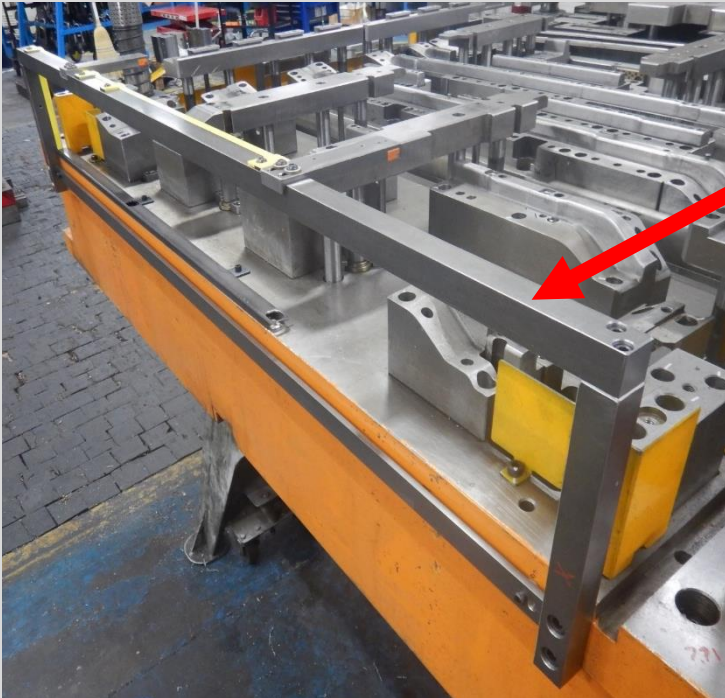
7.29: Part Ejection

All tooling must be designed to allow parts to be blanked through the die or cut free on the end of the die. It is the preference of Marwood to eject all parts through the window of the press in the direction of the feed. Should this not be possible, please consult the Tooling Specialist for other ejection methods.

The incoming strip shall not push the completed part from die area. Scrap and finished parts must be separated by chutes or deflectors. All progressive dies must include a “towel bar” assembly for part ejection sensor mounting.

The final design must be approved by the Tooling Specialist and Senior Department.

Towel Bar for Part Ejection Sensor Mounting



- 1"x1" CRS
- Height and length determined by area needed to eject parts from die with no interface
- Confirmed in die design review

Towel Bar for Part Ejection Sensor Mounting



- Troughs leading to inside of vertical bars

8.0: PHS Tool Design

All PHS Tools will follow the above guidelines with the addition of the details express below.

Developed trim and holes are preferred. Typically, a trim tolerance of ± 1.5 mm or greater should be developed. Holes with a position tolerance of $\pm .75$ or greater should also be developed.

Anything less than these tolerances will require a SPC evaluation to see if developed trim is an option. Tight tolerance trim will be laser cut. This will be evaluated on a per case basis with the Tooling Specialist .
Questionable areas to be planned for development until it proves not feasible during die tryout.
Blanks to be shown in the Marwood oven(s) for layout approval.

Every effort must be made to make the most efficient use of space in the oven. Where possible, two sets of parts should be placed on each shelf. End of Arm Tooling (EOAT) must be accounted for in the layout approval.
CAD (Part) layouts to be submitted to Marwood so the EOAT can be designed, the part data supplied is representative of the production PHS shell prior to the laser process. The concept drawing will be submitted to the supplier before 100% design approval to ensure proper clearances are held. Water flow direction and part load / unload direction to be noted on layout.

50% preliminary design must be submitted for approval, and approved by Tooling Specialist before the design can be completed. A 3D presentation is required. Precise cycle time and temperature will be communicated from Marwood to the Vendor. These numbers must be used during forming development and tryout. Specifically, these numbers will include: blank temperature in oven, the time it takes to get the blank from the oven to press, press speed, and quench dwell time.

For PHS tools, Marwood will do a thermal imaging scan after 30 hits to verify hot zones, spotting accuracy and water flow areas of concern.

95% spotting in the forms is required for even quenching. A high spotted blue panel must be shown to the Marwood Tooling Specialist at die buyoff. This sample is documented by means of a photograph and stored in the project workbook

Buyoff of a hot stamped part must include a 3D scan of the final part in comparison to the CAD model as well as C.M.M. data. Exclusions can be made in the case of a simple 3D profile, and must be arranged in writing ahead of time with the Marwood Tooling Specialist.

All development and tryout attempts will be the responsibility of the Vendor. Do not expect the use of Marwood equipment and personnel unless you have written consent from the Marwood Tooling Specialist .

8.1: Design Elements Specific to PHS tools

A) Design Specific

Ejectors should balance the part for consistent unload.

Whenever possible, ejection pins should be powered by hydraulic pressure.

If they cannot be engaged during forming use hydraulic cylinders so they can be retracted.

Ejectors must not twist or distort the part upon opening of the press.

Ejectors are to be strategically placed in an area of the part that will be laser trimmed off, if this is not possible because of developed trim.

The two way locators (slot) needs to be developed during die trial and to prevent part removal issues

Pierce button jack screw also used as hold down

Tab punches to be P20 material pre hardened 35RC

Add hold down screw to button, will need to validate / cannot mark the part

P20 pre hardened to 38RC for pilot pins.

Pilot land to max of 5mm

Multiple cavity dies require cavity identifiers

B) Cooling Systems

Marwood prefers gun drilled cooling channel systems wherever possible. These channels are typically about 12–15 mm away from the forming surfaces. Size and spacing is dependent on the size of the forms.

The forms must cool the part effectively enough so that the heat treat requirements are fulfilled during a Run @ Rate at Marwood.

Water inlets must not be directly in line with water channels going through the forms. Long water puddles (over 28") should have 2 water inlets and outlets from the water puddles to efficiently disperse the water flow to all water channels.

Traveling pads will also need to be cooled unless provisions can be made to ensure that the pads are not touching the part while the press is closed.

Industrial Rubber Products Ltd. CGAF-1 male cam lock fittings are to be used on tools as the cooling system standard fitting.

Form steels to be designed to allow CNC re-cuts when the tooling needs repair. Cooling channels and holes should be far enough away to allow this.

Hold down screws for all sections should not be more than 4" from each other to secure section to "O" rings for good seal of water to prevent leaks.

Standard size "O" rings to be used throughout the die build(s)

1 Full set of replacement "O" rings is to be supplied with the tool upon successful buy off

Hook ups for water will be whenever possible in the front right of the die. Marking with female (blue) and male (red) fittings. Standard on all hot stamp dies 90 degree connectors to be used.

Final decision on hook up location will be determined at design review.

C) Cylinders

All hydraulics or pneumatic cylinders are to be installed with magnets on pistons for reed switch capability.

The reed switches to be accessible when the die is in the press.

The use of reed switches will be determined in design review.

All nitrogen cylinders that effect dimensional integrity must be on a filler system with sensors.

Die Shoes are to be pocketed to protect nitro fillers, sensors, and junction boxes.

Self Contained Cylinders with considerations for easy removal with the die in the press.

All details mounted to cylinders are to include jam nuts.

Standardize pierce and tab cylinders

Will need spare tab bending tooling and pierce button and punches, this will apply to all PHS dies

Pierce button jack screw also act as hold down

All plumbing fittings to be standard

Hydraulic fittings to be 5/8" on the lower die and 3/4 inch on the upper

Union joints on water lines to allow for easy removal / repair

Sensor

Junction boxes and sensors to be installed as part of the die build.

Marwood will terminate the sensors at Marwood prior to die buy-off

Separate quick connections for Tab cylinder (large) and Ejector cylinder (small)

Sensor box to be on the left side in the area of the safety block

Ring sensors to be added to detect slug evacuation .

PHS Die - Sensoring

Supplier	Part Description	Manufacturer	Part Number	Qty. Used.
Westburne	4" x 4" Box (Up to 8 Sensor Wires)	Hoffman	A404CH	1
Westburne	4" x 6" Box (Over 8 Sensor Wires)	Ralston	IBOH-060403	1
Westburne	Upper Junction Box (Where aplicable)	Hamond	1590Z100	1
Westburne	6 Wire Pig Tail	Turk	RKC 67-3.3/S90 SP	2
ITC	Pig Tail Strain Gauge	Unknown	180.717	4
ITC	Sensor Wires Strain Gauge	Unknown	180.75	2
IFM	Pressure Sensor (1 per Filler)	IFM	PN7370	1 Per
IFM	Sensor Bracket (1 per Filler)	IFM	E30421	1 Per
IFM	Cables (1 per each Connection)	IFM	EVW005	1 Per
IFM	Ring Sensor (Any in Die Piercing)	IFM	17R217	1 Per
Parker	Reed Switch (2 per Hydraulic _Pneumatic Cylinder)	Parker	P8S-GPMHX	2 Per
	(Reed Switch Depends on Model of Cylinder)			

9.0: Die Sensors

Marwood has implemented a Die Sensor Program, headed by the Marwood Tool Room & Marwood Engineering. The team will be involved in all design reviews and approvals. They will be held responsible for ensuring that all of the necessary provisions for die protection are included in the die design. **The features identified here in the standards must be included in the original quoted die cost which include the installation of the sensors. The type of sensor will be directed to the tool source during the design reviews.**

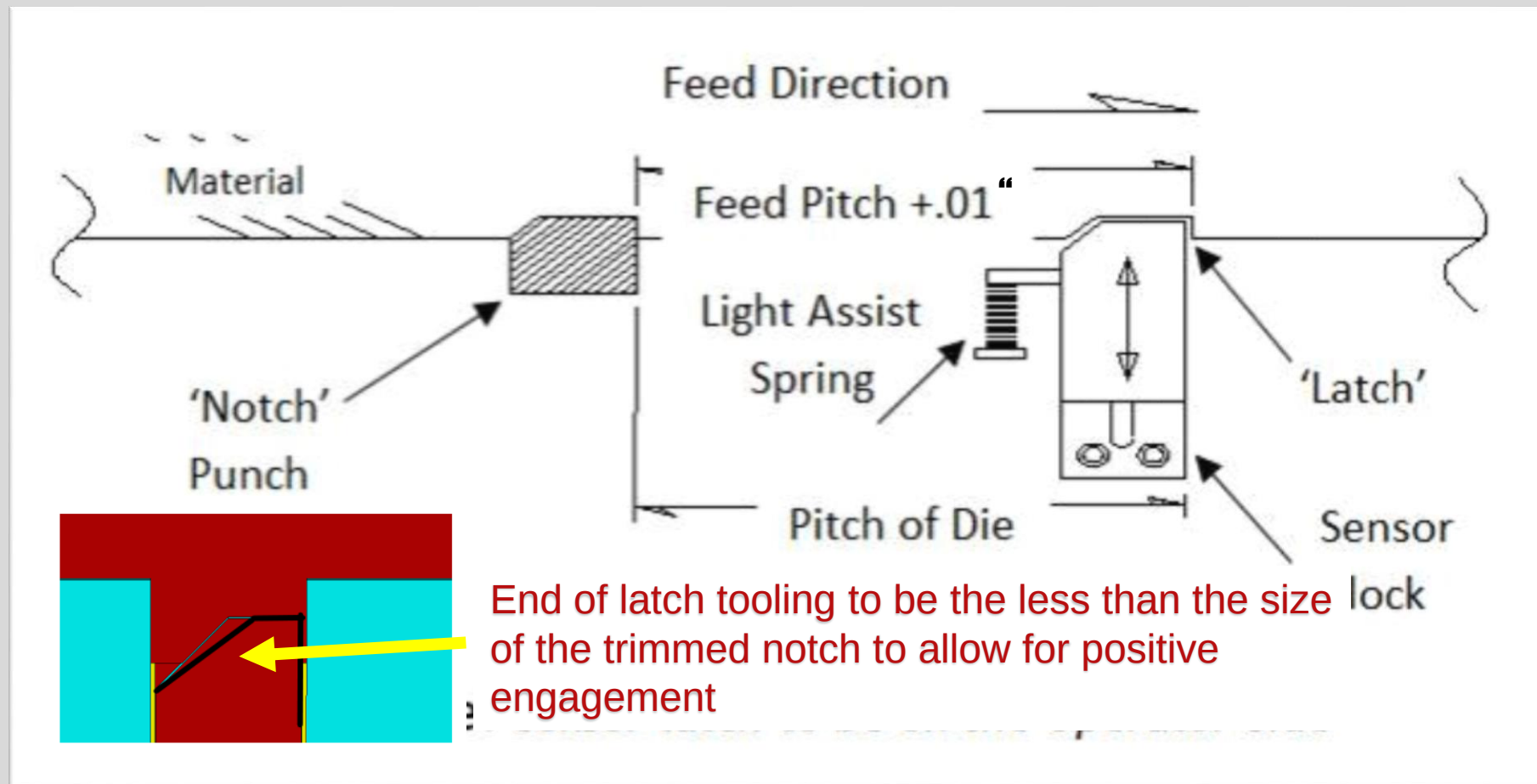
9.1: Notch & Latch Sensor

All progressive dies must have a die protection system that will check for a complete feed. The use of 'Notch and Latch' is standard. Use a fringe cut with a notch and latch sensor to verify the strip location in all progressive dies (**see Figure 9**). This fringe stop die protection will be mounted on a fixed rail. The latch assembly must extend over the top face of the sensor block. Where possible, the Light Assist Spring must be internal. The "Latch" must have a minimum ¼" (6mm) threaded hole in the back face. The use of a notch and latch is standard on all progressive dies to check for complete feed and over feed. The use of a Marwood standard size notch punch and button are required for the fringe cut.

The latch assembly will be mounted on a fixed rail on the operator side of the die, the assembly must extend over the top face of a Marwood standard sensor block. (light assist Spring (1/4" dia.) for return)

The following slides will demonstrate the Marwood standard for latch and buckle and sensor blocks

Figure 9: Notch & Latch Sensor



Senor Types

Senor types that are to be used for the feed latch, cam return and anti buckle



<u>STANDARD SENSORS ON ALL DIES</u>		<u>PREFERED SENSOR STYLE</u>		<u>WHERE FROM AND PART #</u>
Sensor #1 Short Feed		Normally closed flat Pac sensor		HTM sensor - Part# MQM1-8802P-B3U0.3/P8-PTFE-100C
Sensor #2 Material Buckle Latch Style		Normally open flat Pac sensor		HTM sensor - Part# MQM1-8802P-A3U0.3/P8-PTFE-100C
Sensor #2 Material Buckle No Latch		Prefer a thru beam sensor		KEYENCE thru beam sensor, 2 different kinds, depends on the die on which is used and how Part# PR-M51C3PD(regular style) or Part# PR-F51C3PD(flat style)
Sensor #3 (&4 if 2 out) Part Ejection		Thru beam sensors 1 per part		Same as above, we use either one depending on the situation and space but same part #s
Cam Sensors		Normally open flat Pac sensor		Same sensor as sensor #2 latch style sensor. One for each pierce cam as of right now we do not sensor form cams.
				Every sensor also needs a connecting cord - IFM Part# EVC142

9.2: Aerial Cam Protection

All dies which incorporate aerial cams must also use a ‘part in place’ sensor in order to ensure that the blank/part is properly located on the tool prior to the press stroke. The cam must have return sensors. The type and location of this sensor must be discussed with Tooling Specialist and Tool Room..

9.3: Stripper Standoffs

Stripper Standoffs are used as a slug detection method on all strippers in pierce and/or cutting operations (**see Drawing 18 & 19**). Please use the details provided to determine the Stripper Standoff height (**see Table 4**). There should be no holes located over stripper standoffs.

9.4: Sensor Locations

All die protection sensors must be mounted on the operator side (front) of die, unless approved by the Tooling Specialist

9.5: Wiring

In order to facilitate the installation and wiring of these sensors, there is a requirement to include troughs in the die set. It is favorable to have the sensor troughs extend through the outer most edges of the die shoe in both the left to right and front to rear directions to further facilitate drainage. This will be reviewed during the design stage. These slots must include drain holes as shown (**see Drawing 8**).

9.6: Additional Information

For your convenience, 3D CAD models are available for items shown on Drawings 10–19 and Figures 23–25 at www.marwoodinternational.com. These details are provided in PRT, and STP formats.

Table 4: Stripper Standoff Height

Material Thickness (in)	Height of Stripper Standoff (above cutting height)
0.1 and under	1/2x material thickness
0.101 - 0.160	3/4x material thickness
0.161 and up	1x material thickness - 0.05”

9.7: Buckle Sensor

- All progressive dies must include a 'Buckle Sensor' mechanism. A lever style (see **Figure 10 & 11**), or plunger style (see **Figure 12**) are acceptable. The lever style is common on single out progressive die applications where a single sided carrier is standard. The plunger style is best suited on 2-out progressive dies where a center carrier is typical. The final design must be approved by Marwood Engineering and Tool Room. In the event that more height is necessary, the vendor shall install mounting blocks as it is not appropriate to deviate from the provided designs. All progressive dies must include a v-block plunger style 'Material Buckle Sensor' which contacts the carrier strip. The final design must be approved by Marwood Engineering and Sensor Department. In the event that more height is necessary, the vendor shall install mounting blocks as it is not appropriate to deviate from the provided designs. The v-block plunger assembly can be extended over the top face of a Marwood standard sensor block when suited. The Light Assist Spring (1/4 Dia.) must be internal

Figure 10: Buckle Lever Assembly LH

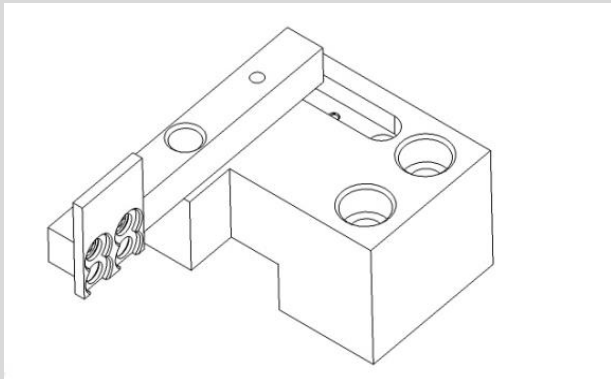


Figure 11: Buckle Lever Assembly RH

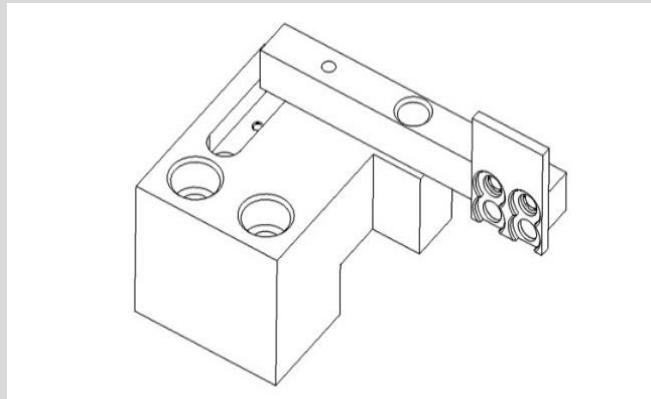
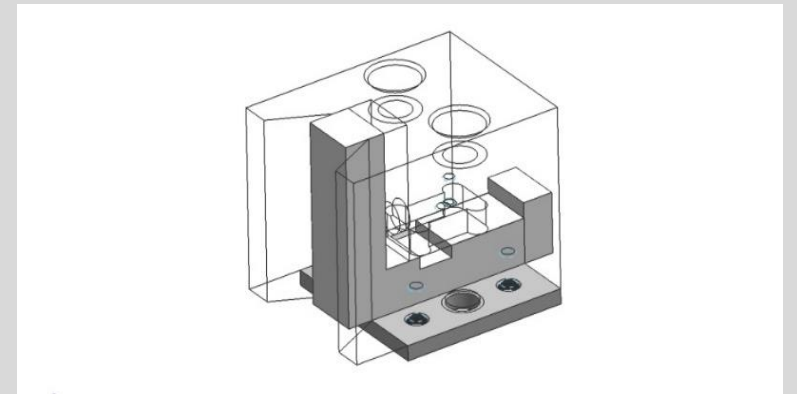


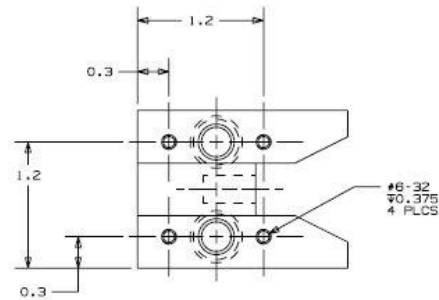
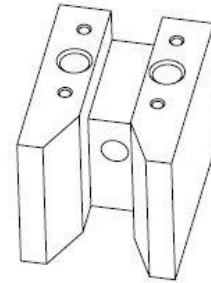
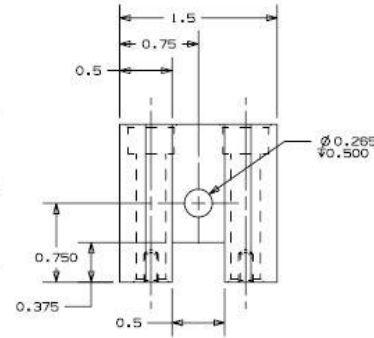
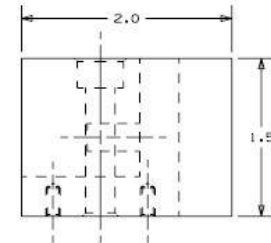
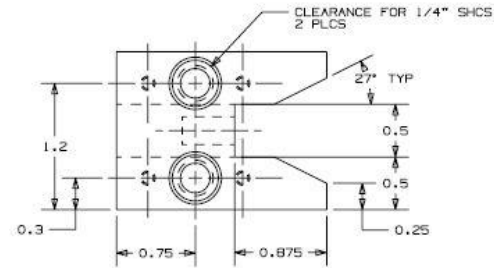
Figure 12: Buckle Plunger Assembly



Note: To build this assembly, use Drawings 11, 12 & 14.

Note: To build this assembly, use Drawings 15-17.

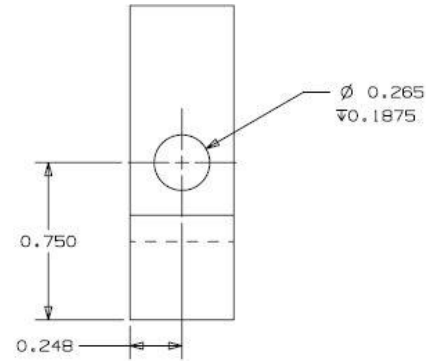
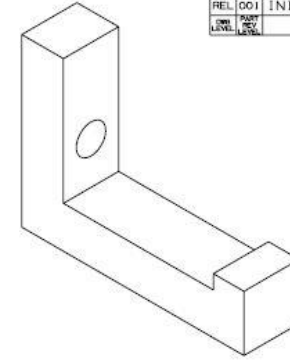
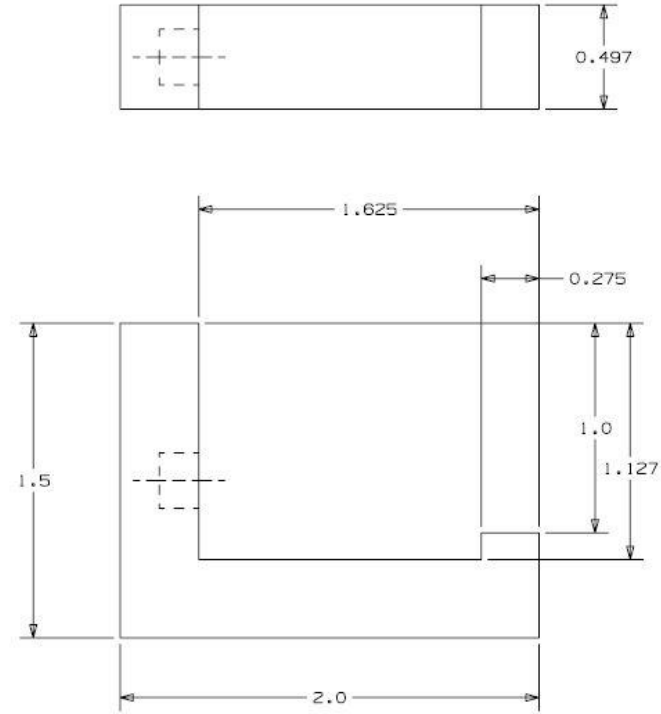
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REL 001		INITIAL DWG REL	TB	01-SEP-00
REV LEVEL		DESCRIPTION	INT 144	DATE



TOLERANCES
 .X ±0.020
 .XX ±0.010
 .XXX ±0.005
 UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE REFERENCE ONLY CAD DATA IS MASTER	CONTRACT NO SENSORS			MARWOOD		
	APPROVALS LIST			TITLE BUCKLE PLUNGER BLOCK		
MATERIAL MILD STEEL	NAME TB	SIGNATURE	DATE 01/08/09	SIZE B	3RD ANGLE PROJECTION	DWG NO MMF DWG-17
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FINISH NONE	CUSTOMER MARWOOD					

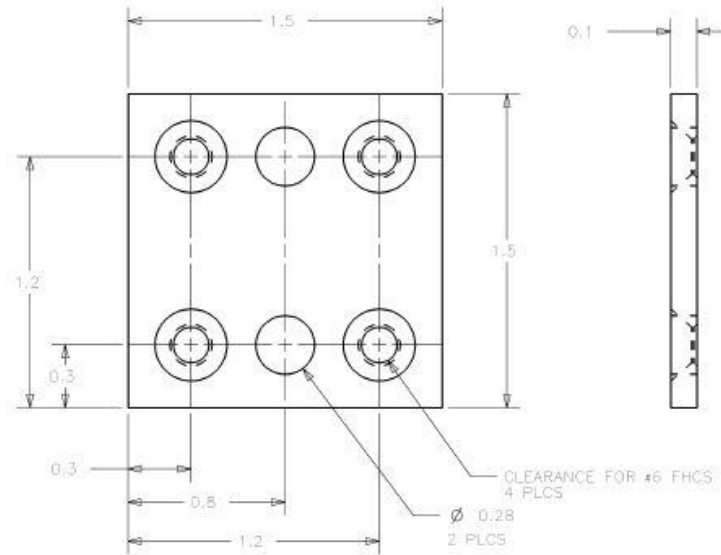
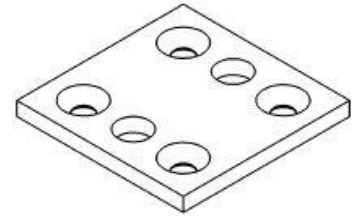
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REL	001	INITIAL DWG REL	TB	31-AUG-00	
REV	LEVEL	DESCRIPTION	INITIAL	DATE	



TOLERANCES
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 .XX ± 0.010
 .XXX ± 0.005
 UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE REFERENCE ONLY CAD DATA IS MASTER	CONTRACT NO SENSORS			MARWOOD	
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MATERIAL MILD STEEL	NAME	SIGNATURE	DATE	SIZE	3RD ANGLE PROJECTION
	DRWN TB		31/08/08	B	
FINISH NONE	CHECKED JF		31/08/08	DWG NO	MMF DWG-16
	CUSTOMER MARWOOD			SCALE DNS (CAD FULL)	WEIGHT N/A
				SUPPLIER TOOL SHOP	

REV	001	INITIAL DWG REL	TB	31-08-09	
DATE	REV	DESCRIPTION	BY	DATE	



TOLERANCES
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 .XX ± 0.010
 .XXX ± 0.005
 UNLESS OTHERWISE SPECIFIED

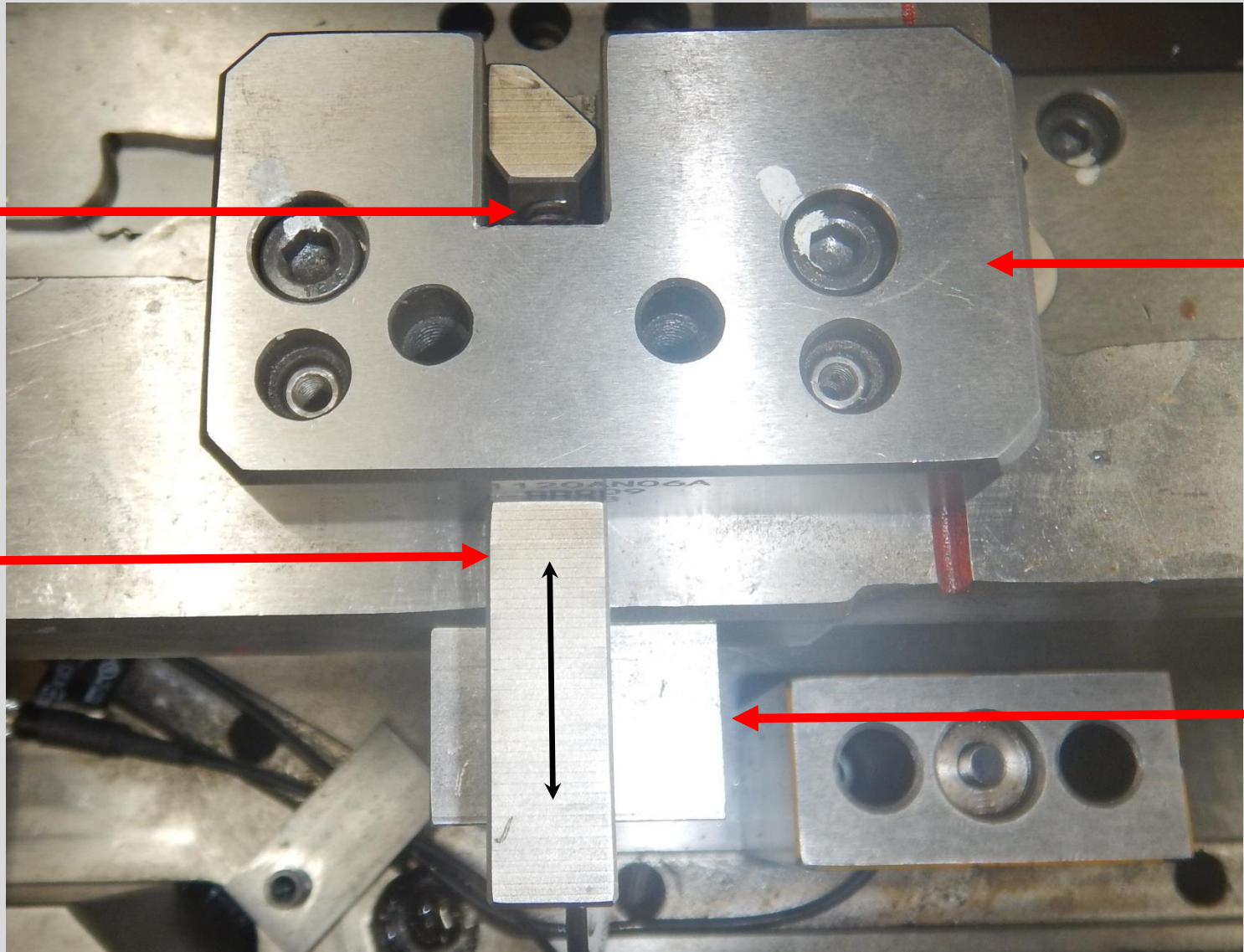
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	NAME	SIGNATURE				
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MATERIAL MILD STEEL	CHECKED	JF	31/08/09	B	DIMENSION IN INCHES	MMF-DWG-15
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Light Assist Spring
1/4 Diameter

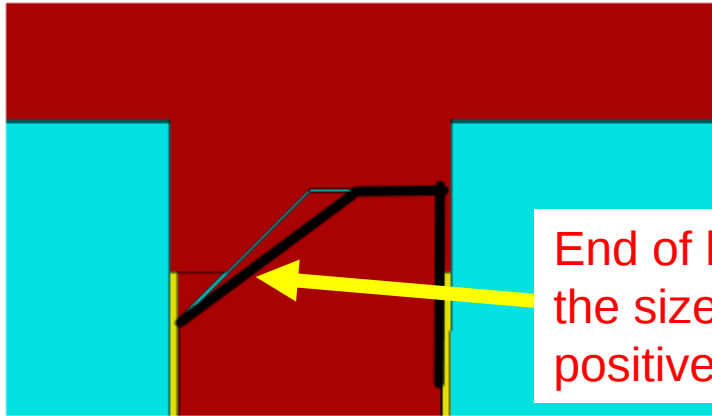
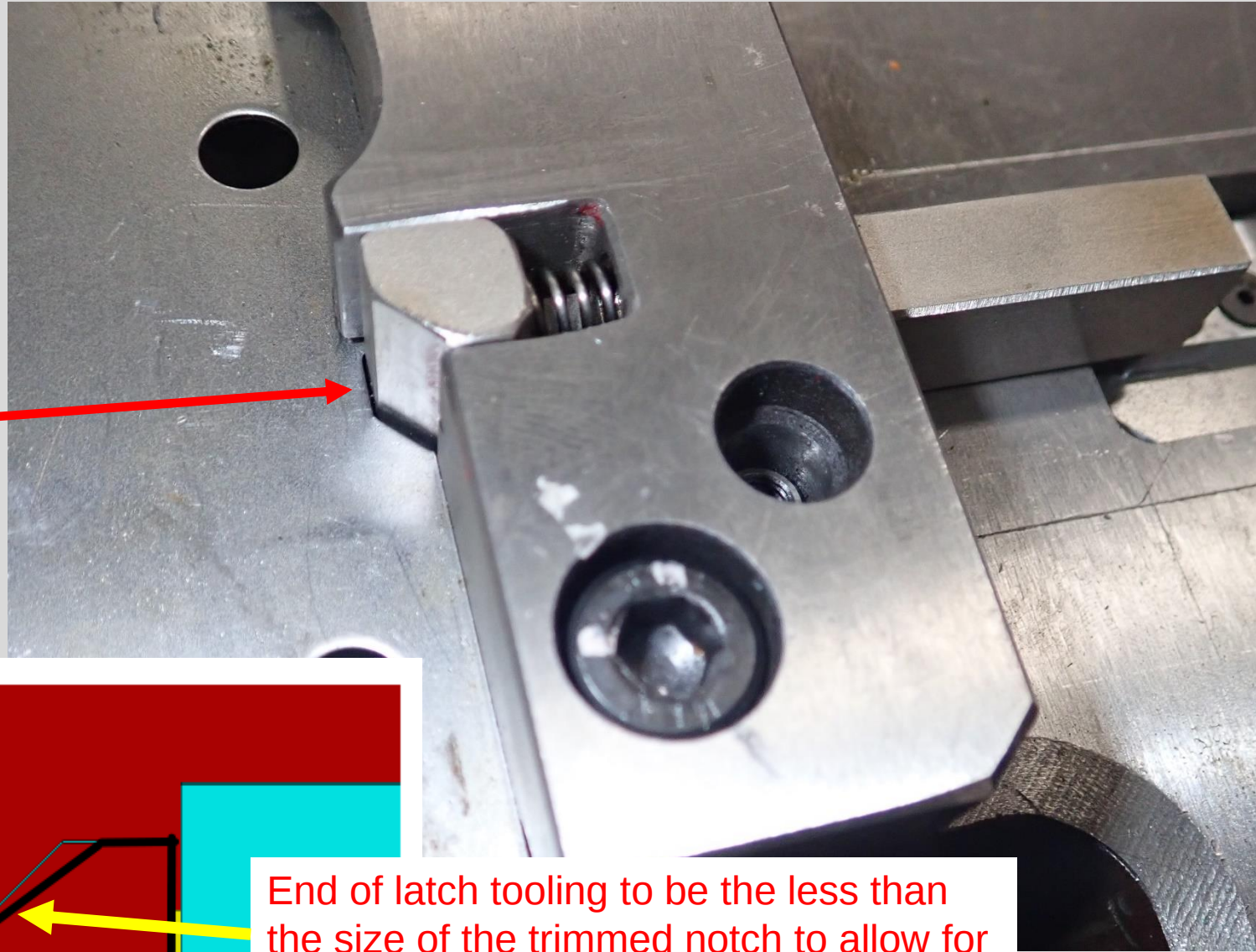
Fixed Rail on
Operator Side

Latch – Will be
machined to length
after sensor is
mounted at
Marwood

Marwood Standard
Sensor Block

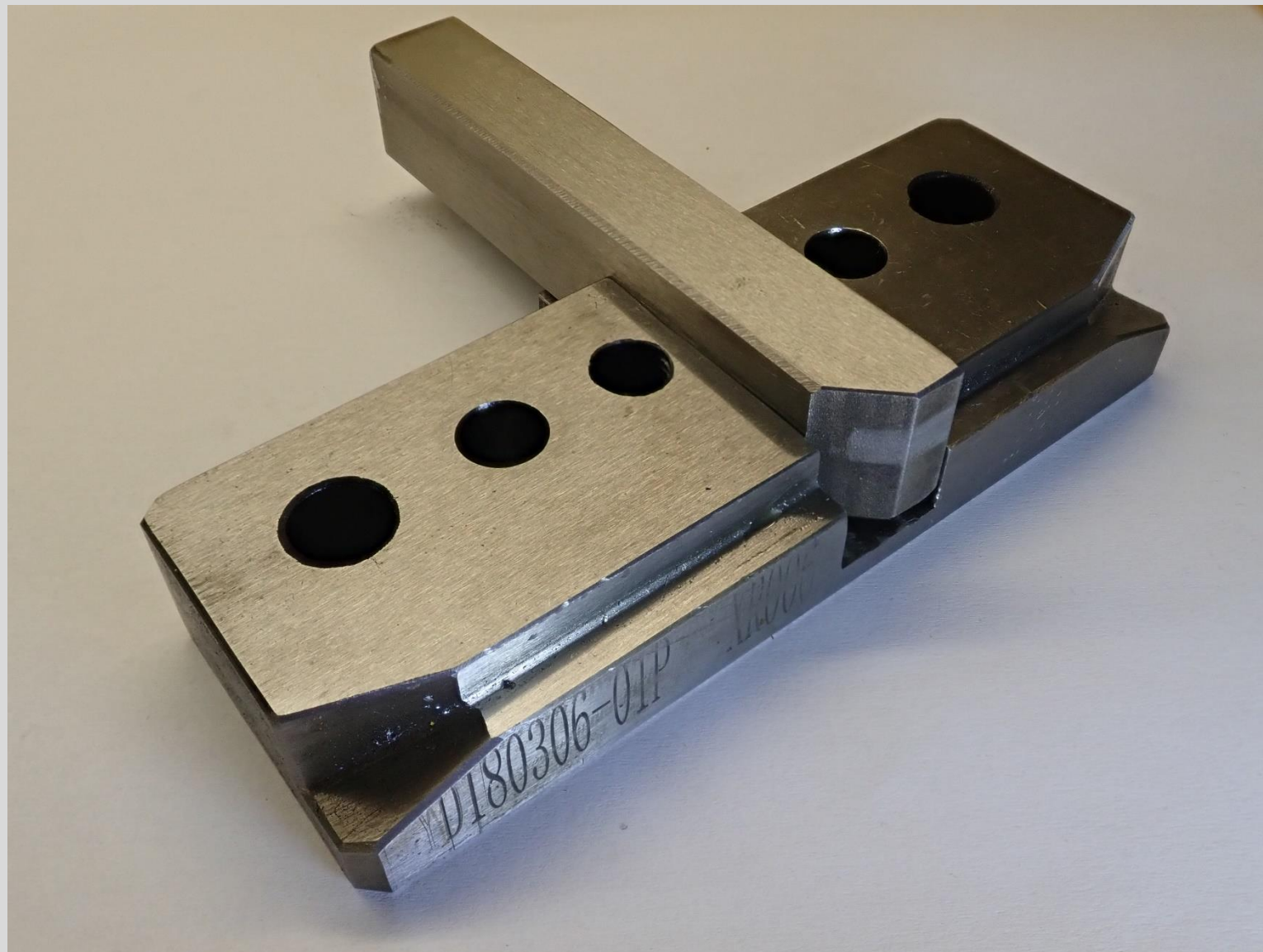


Standard Fringe Cut

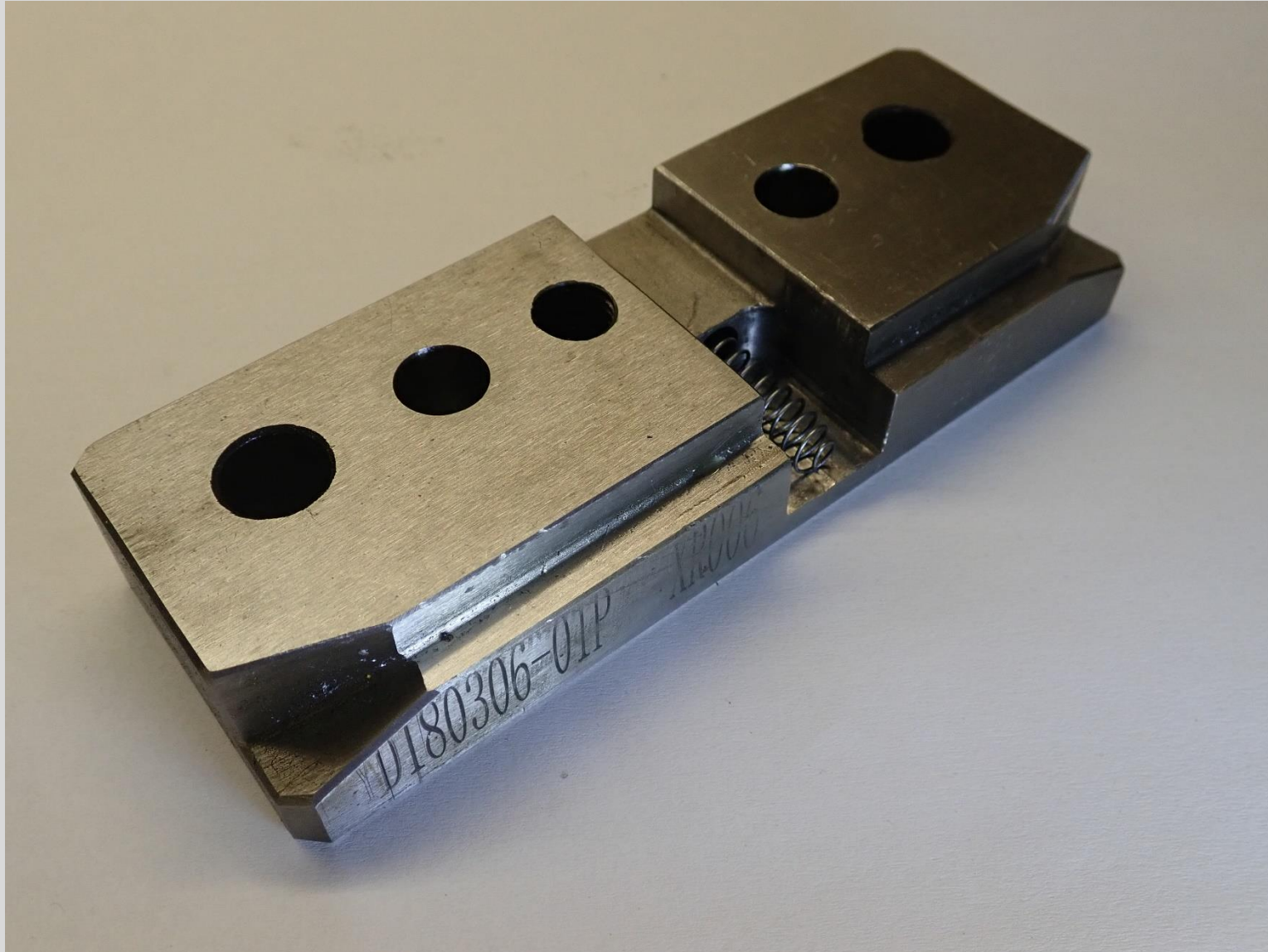


End of latch tooling to be the less than the size of the trimmed notch to allow for positive engagement

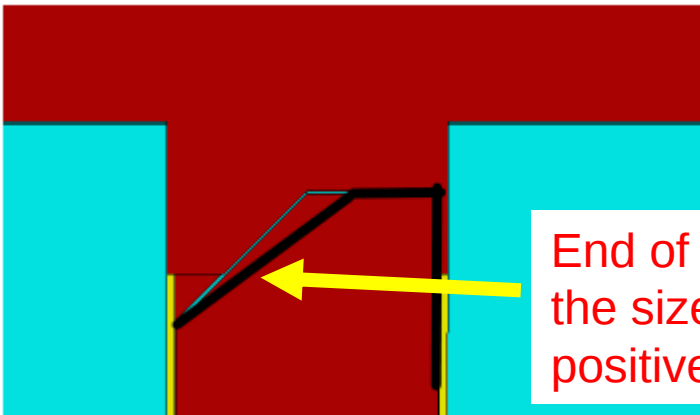
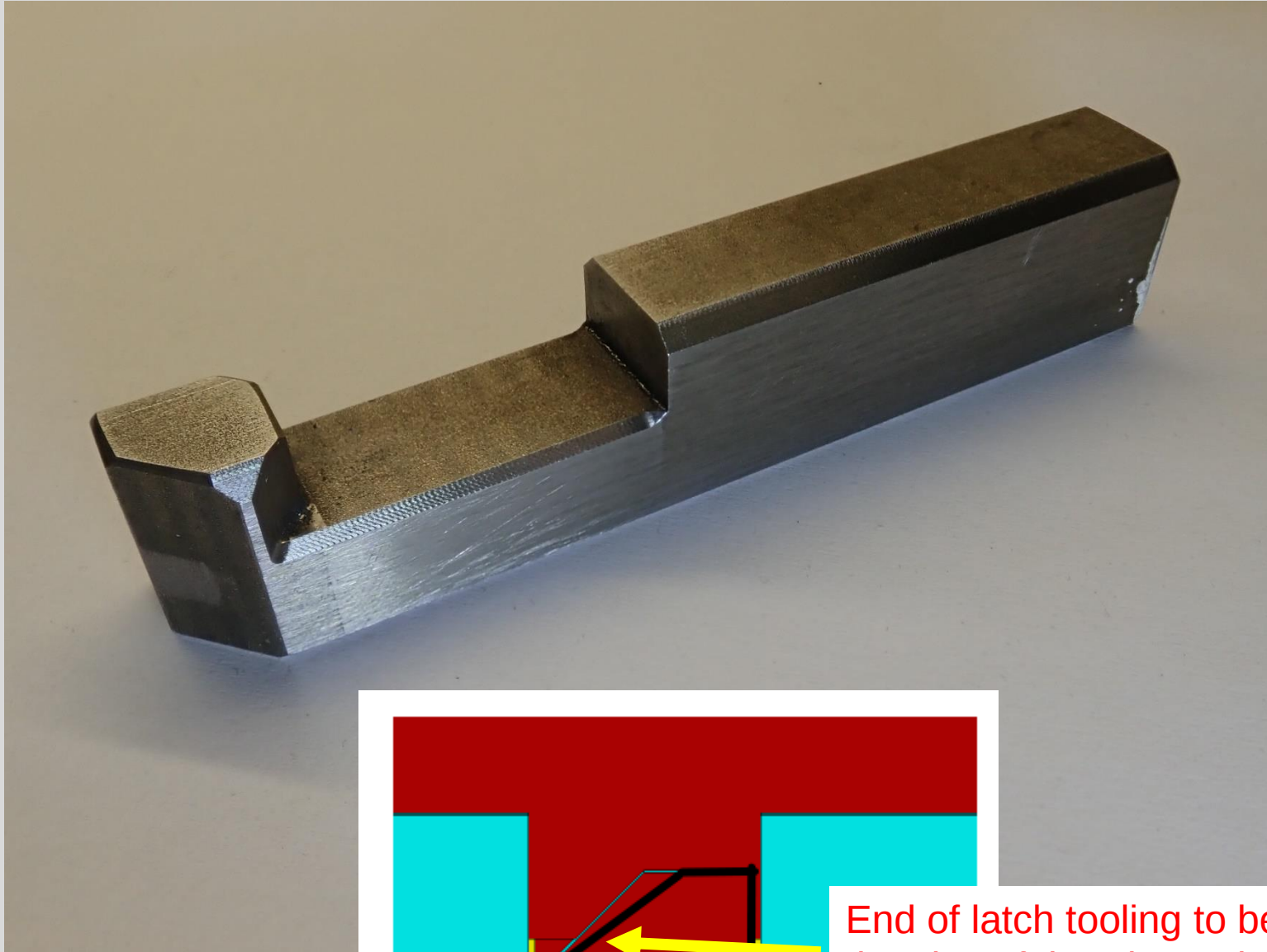
Bottom Profile of
Fixed Rail with Latch



Bottom Profile of
Fixed Rail without
Latch

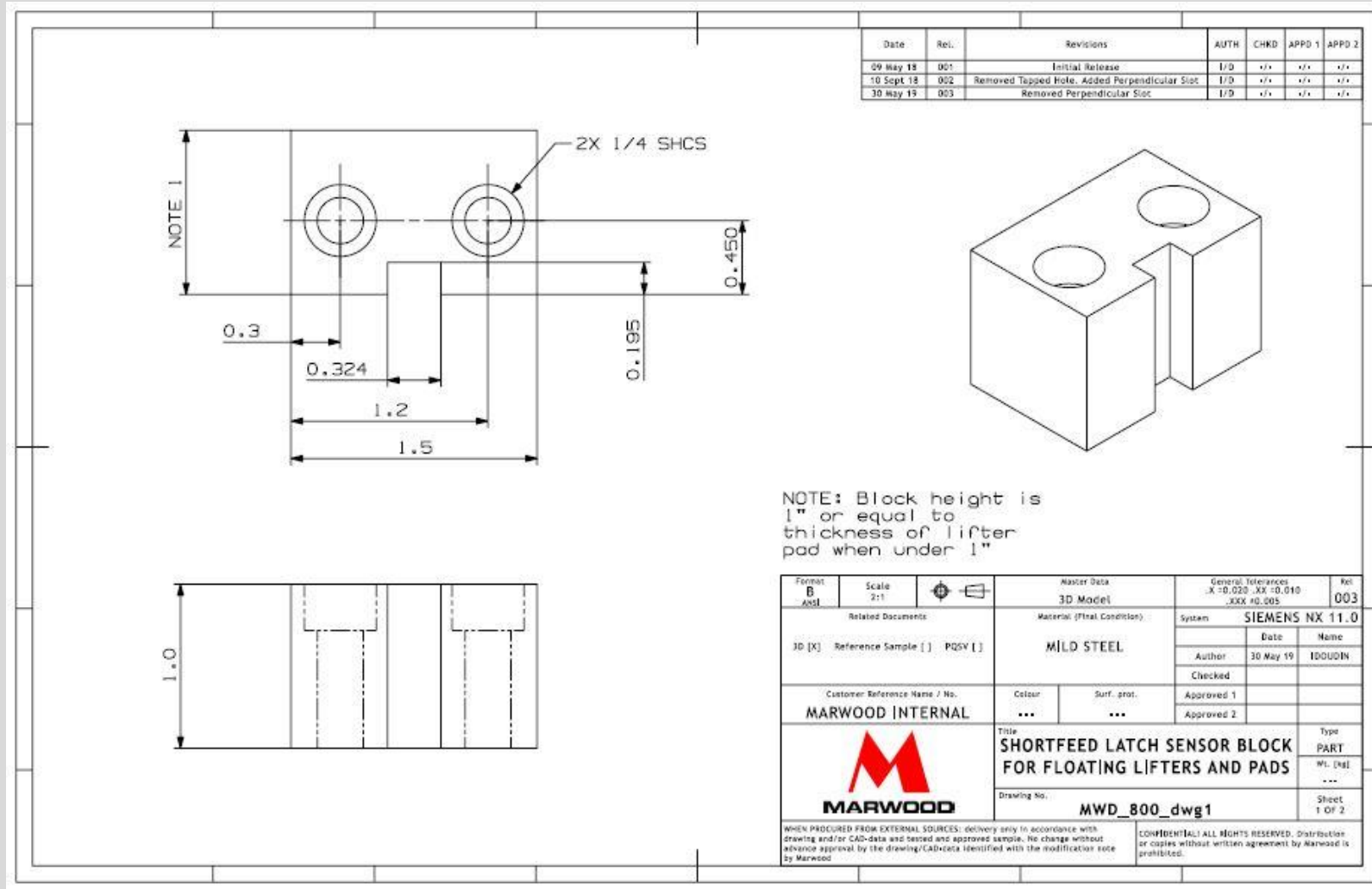


Latch Profile



End of latch tooling to be the less than the size of the trimmed notch to allow for positive engagement

Marwood Standard Sensor Blocks

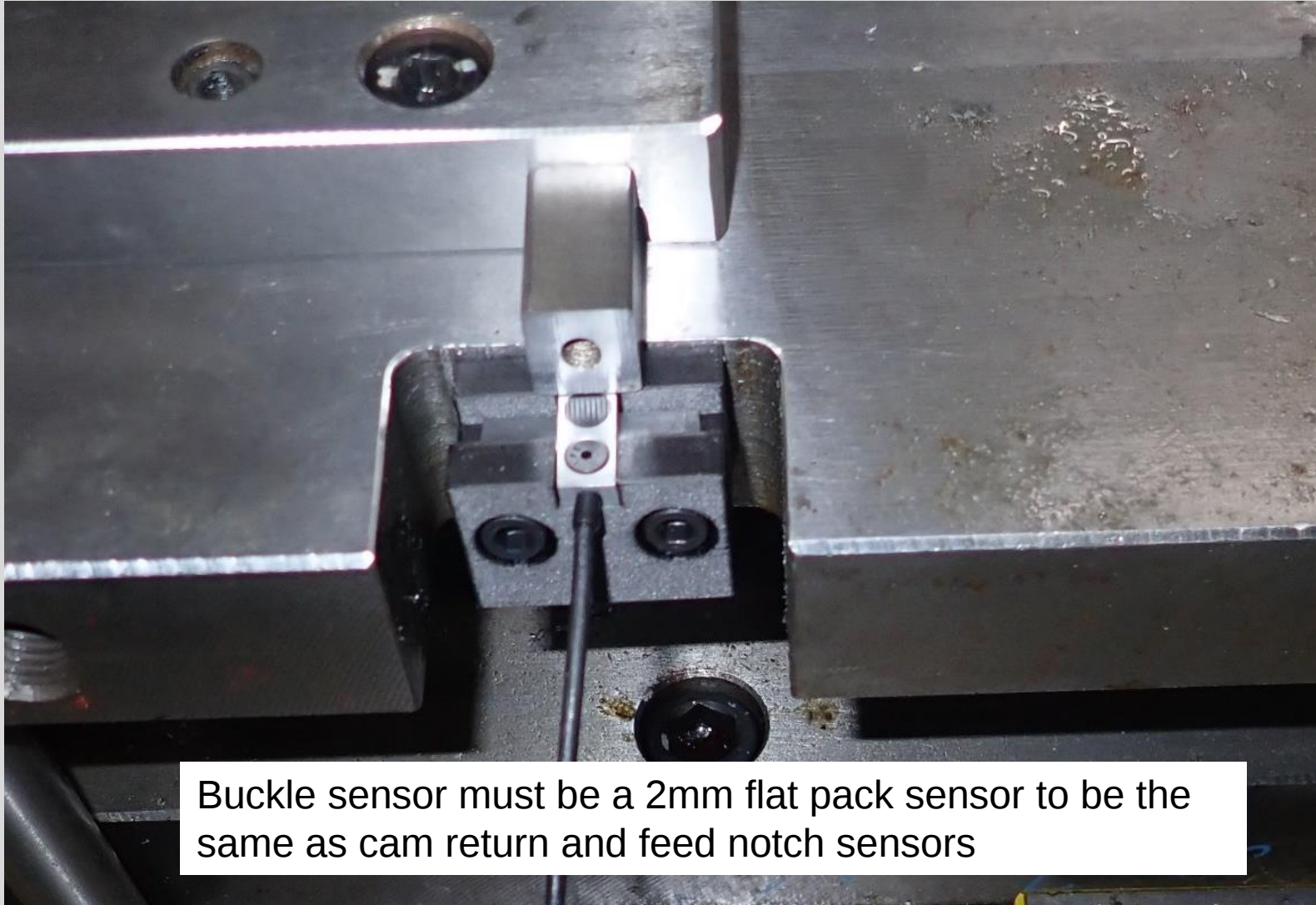


- To be mounted on the side of a floating lifter bock or plate under the latch

Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

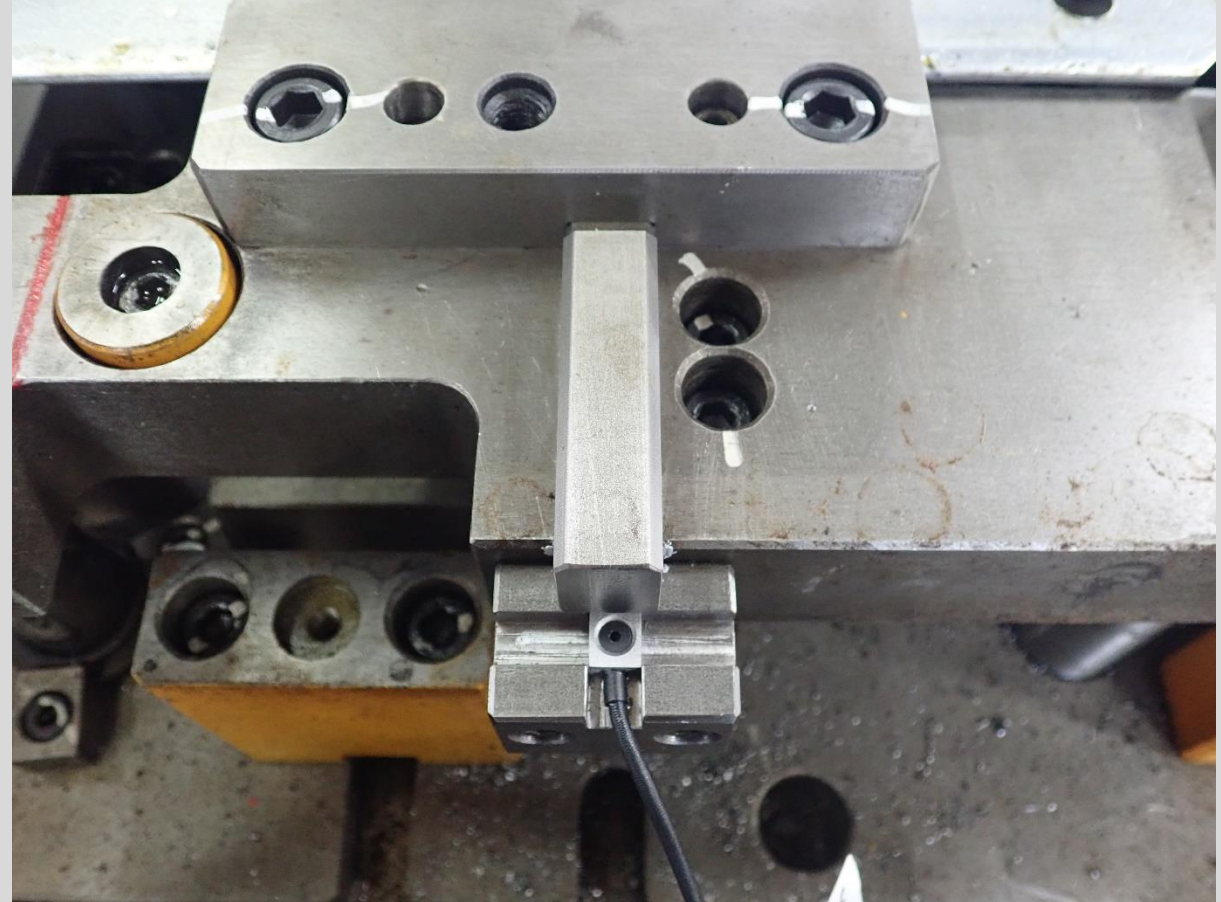
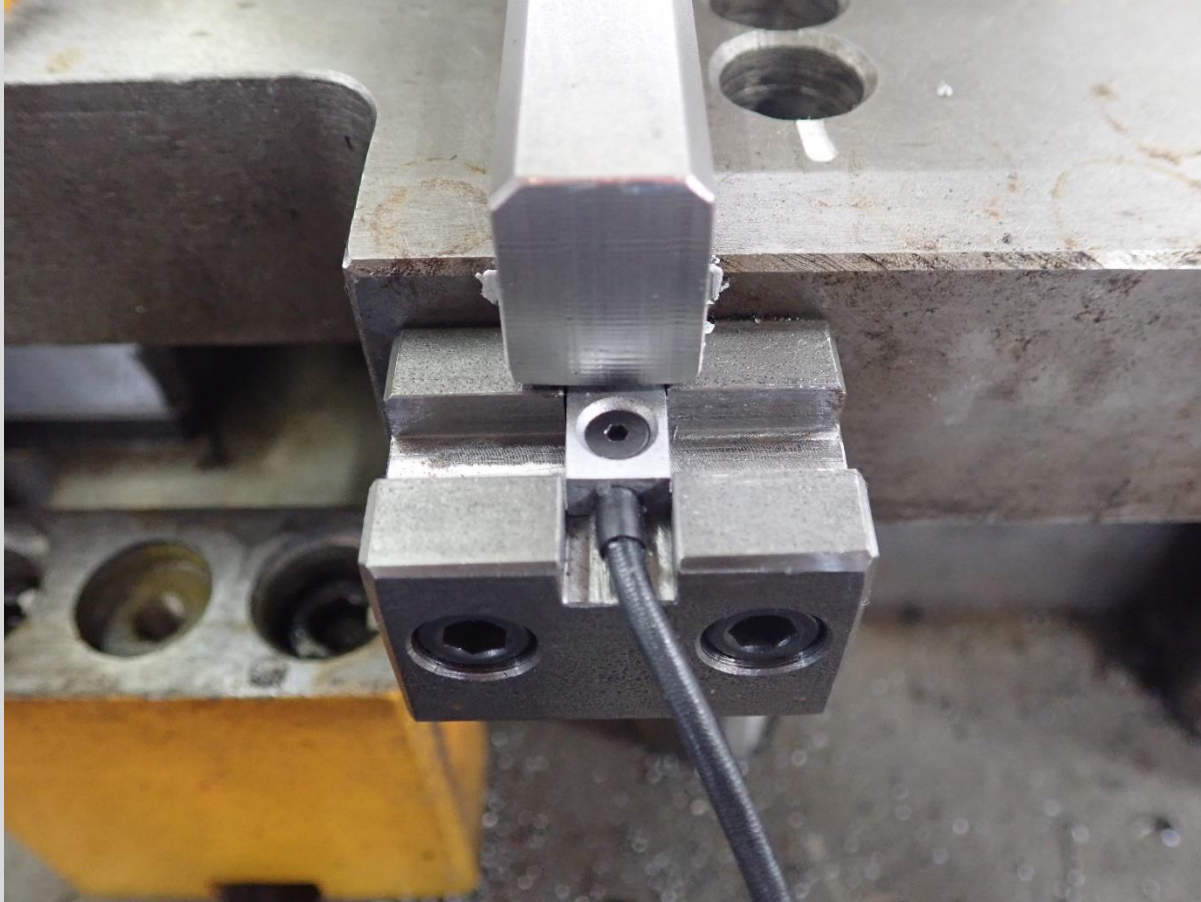
Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

Marwood Standard Sensor Blocks



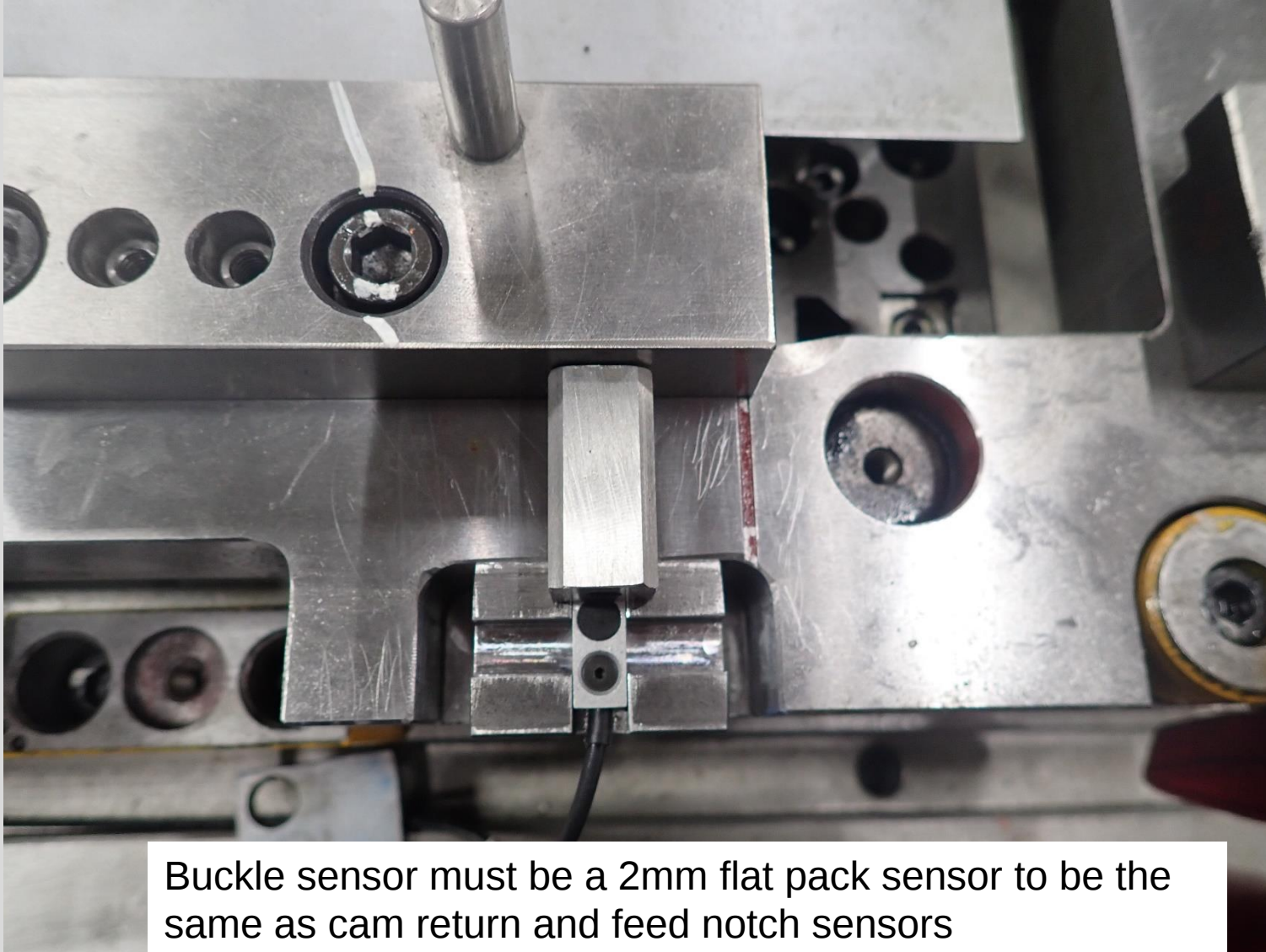
Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

Marwood Standard Sensor Blocks



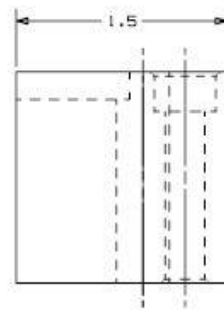
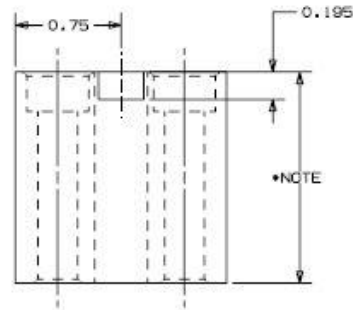
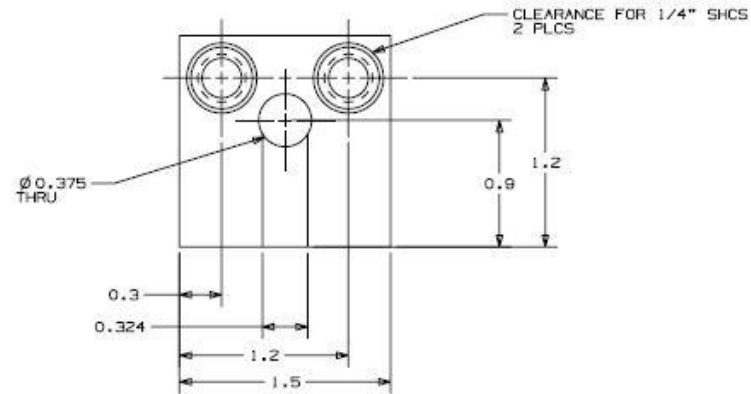
Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

Marwood Standard Sensor Blocks

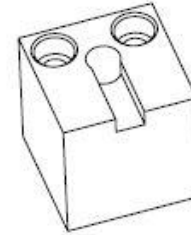


Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

Marwood Standard Sensor Blocks



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002	UPDATED HOLE SIZE	10 09-MAY-10
REL 001	INITIAL DWG REL	TB 31-AUG-08



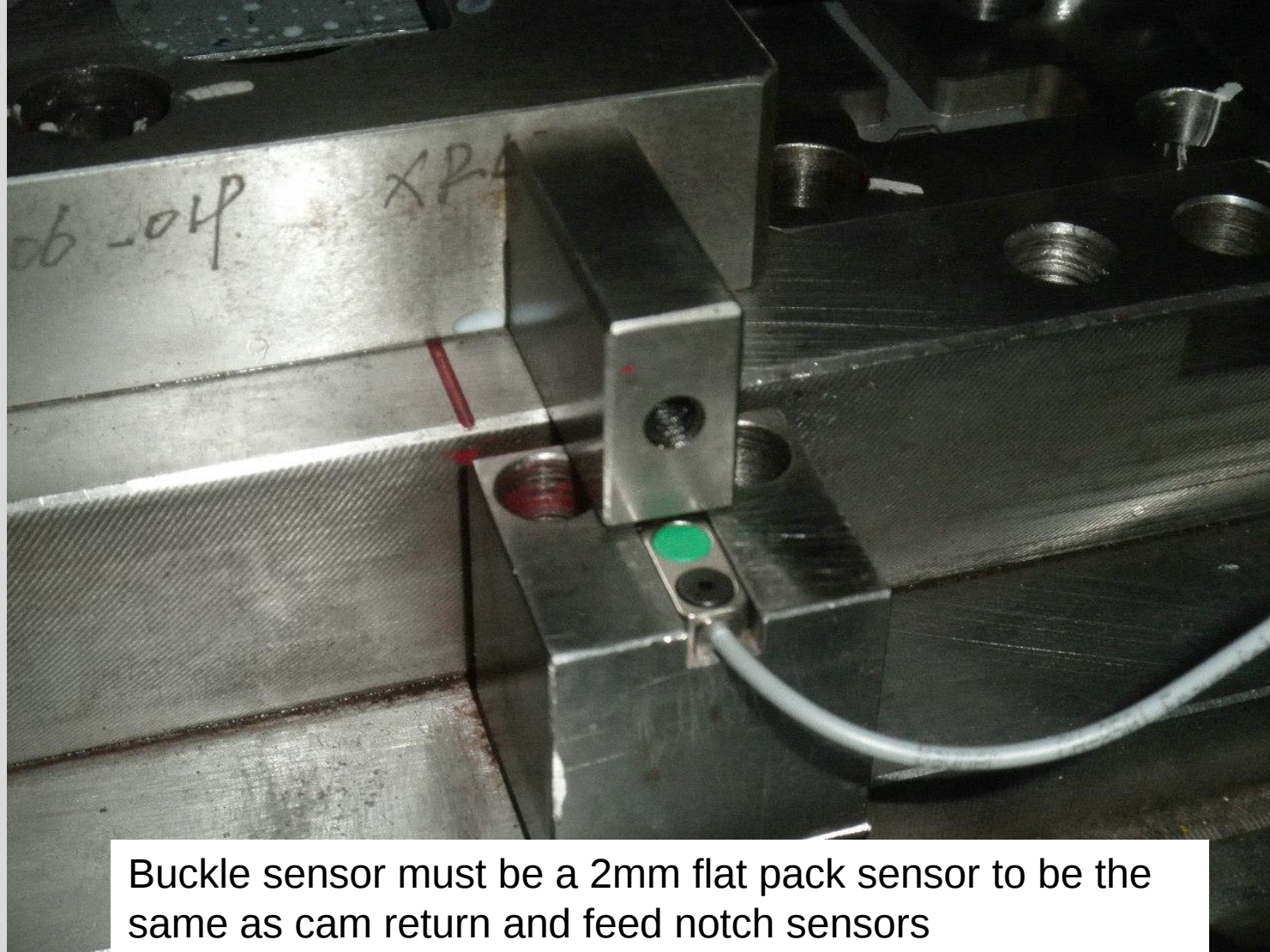
TOLERANCES
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 .XX ±0.010
 .XXX ±0.005
 UNLESS OTHERWISE SPECIFIED

*NOTE
 BLOCK HEIGHT IS EQUAL TO
 DIE CUT HEIGHT

ALL DIMENSIONS ARE REFERENCE ONLY CAD DATA IS MASTER	CONTRACT NO SENSORS		MARWOOD MARWOOD	TITLE SHORTFEED LATCH SENSOR BLOCK	
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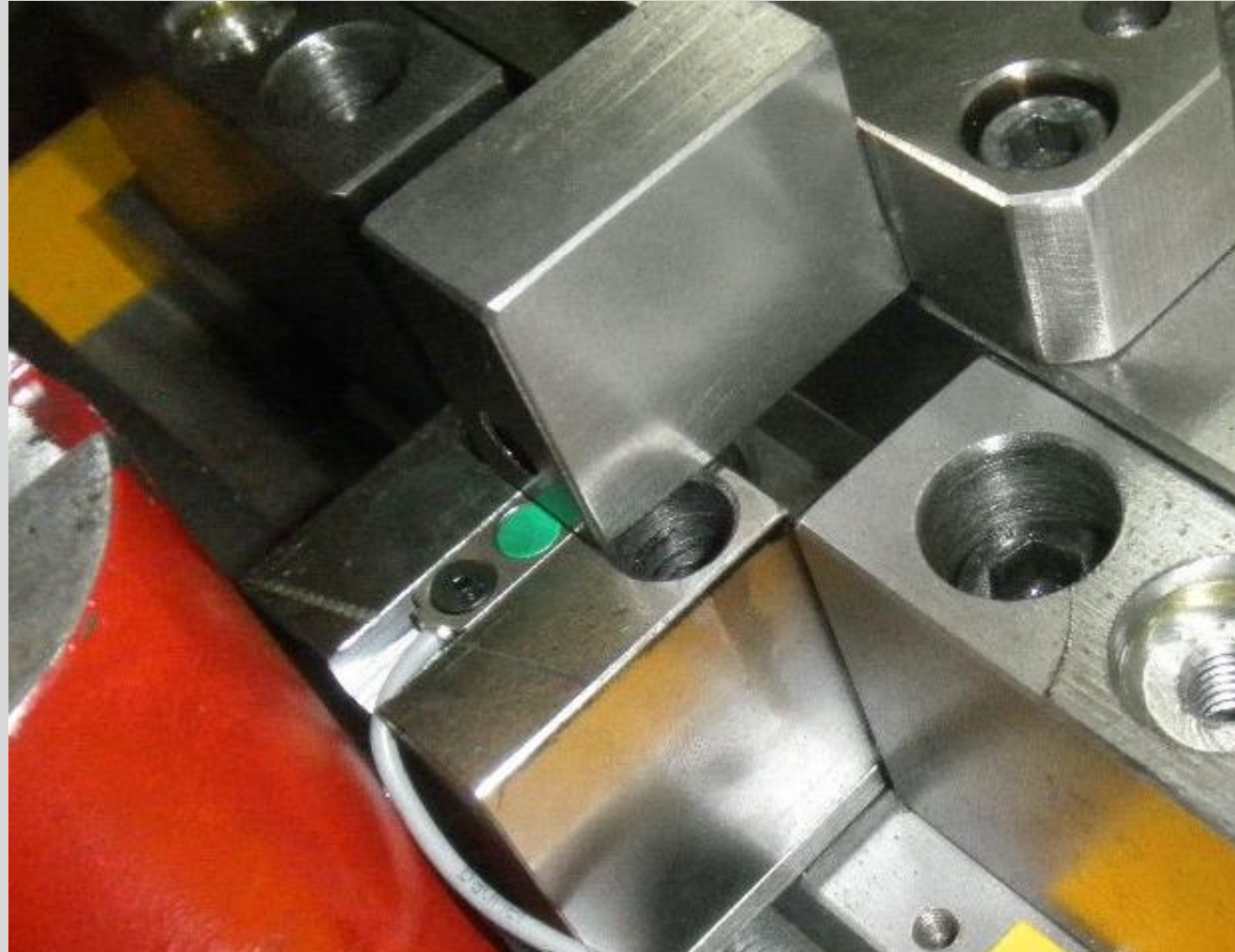
- To be mounted to the die shoe or sub plate under the latch

Marwood Standard Sensor Blocks



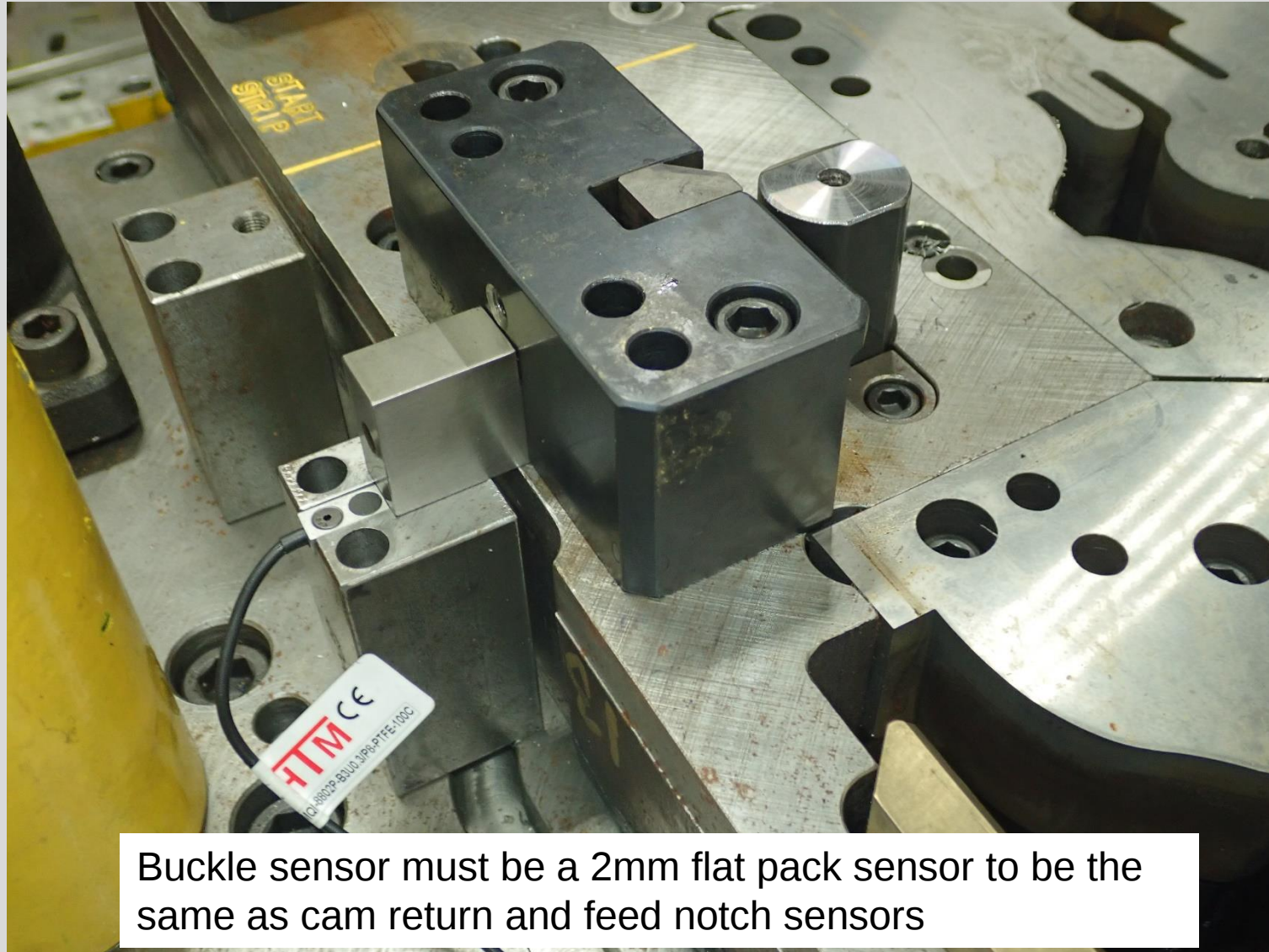
Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

Marwood Standard Sensor Blocks



Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

Marwood Standard Sensor Blocks

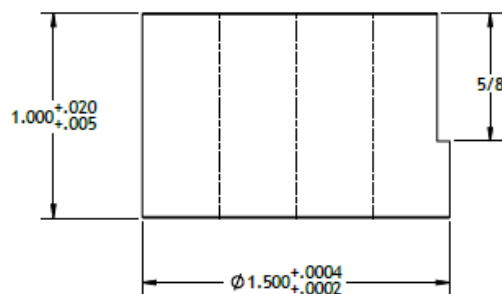
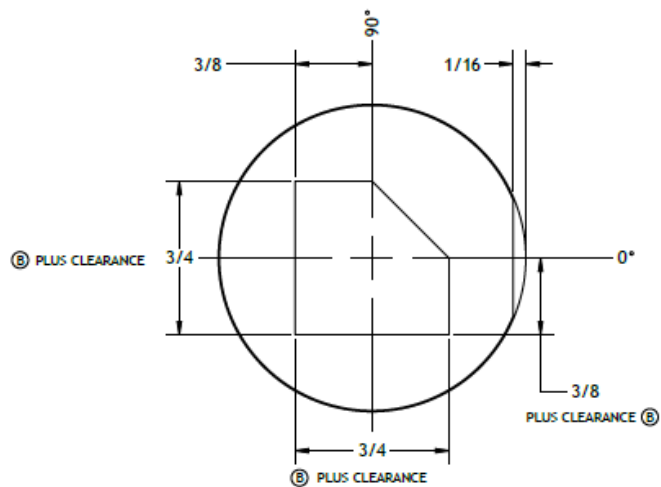


Buckle sensor must be a 2mm flat pack sensor to be the same as cam return and feed notch sensors

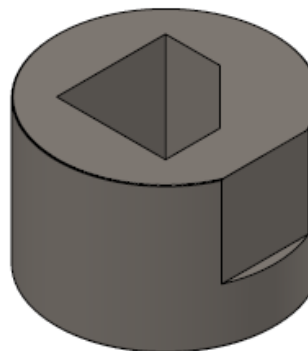
Marwood Standard Notch Cut



Standard Imperial Notch Buttons and Punches



REVISIONS		
REV.	DESCRIPTION	DATE
A	INITIAL RELEASE	6/7/2019
B	PLUS CLEARANCE	7/17/2019

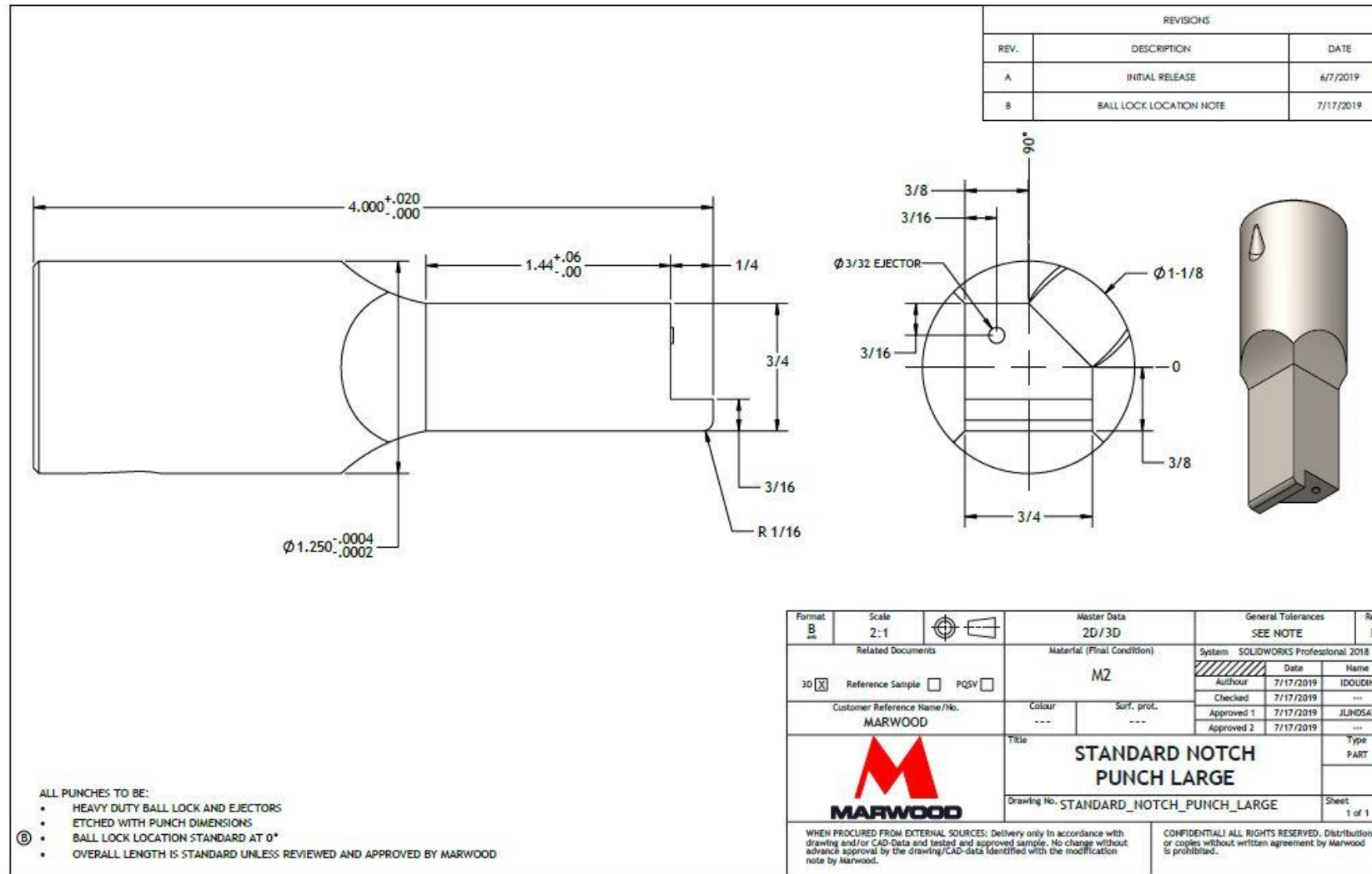


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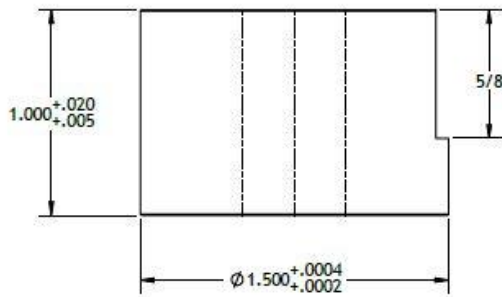
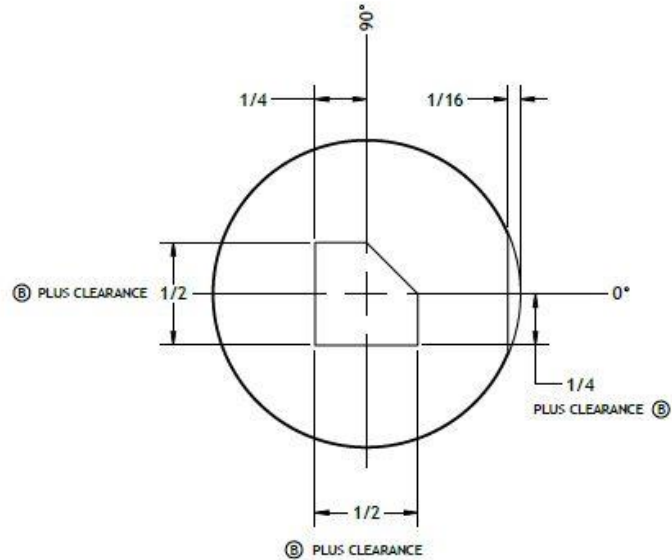
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- LONGER OVERALL LENGTHS ACCEPTABLE BY APPROVAL
- ORIENTATION OF KEY TO BE LOCATED AT 0° WHENEVER POSSIBLE
- ETCHED WITH PUNCH DIMENSIONS
- MADE OF M2 OR EQUIVALENT
- HOLE SIZE BASED ON MATERIAL CLEARANCE

Format B	Scale 2:1		Master Data 2D/3D		General Tolerances SEE NOTE			Re E	
Related Documents			Material (Final Condition)		System SOLIDWORKS Professional 2018				
3D ☒ Reference Sample ☐ PQSV ☐			M2 OR EQUIVALENT			Date	Name		
Customer Reference Name/No. MARWOOD			Colour ---		Surf. prot. ---		Author	7/17/2019	IDOUIN
							Checked	7/17/2019	---
							Approved 1	7/17/2019	JLINDSAY
					Approved 2	7/17/2019	---		
 MARWOOD			Title		STANDARD NOTCH BUTTON LARGE			Type PART	
			Drawing No.		STANDARD_NOTCH_BUTTON_LARGE			Sheet 1 of 1	
WHEN PROCURED FROM EXTERNAL SOURCES: Delivery only in accordance with drawing and/or CAD-data and tested and approved sample. No change without advance approval by the drawing/CAD-data identified with the modification note by Marwood.					CONFIDENTIAL! ALL RIGHTS RESERVED. Distribution or copies without written agreement by Marwood is prohibited.				

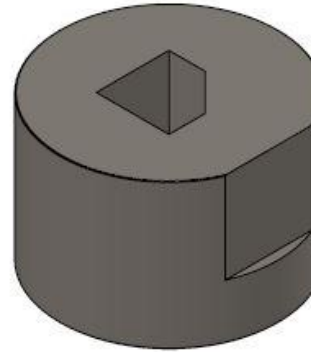
Standard Imperial Notch Buttons and Punches



Standard Imperial Notch Buttons and Punches



REVISIONS		
REV.	DESCRIPTION	DATE
A	INITIAL RELEASE	6/7/2019
B	PLUS CLEARANCE	7/17/2019



ALL DIES TO BE:

- TAPER RELIEF .006 / PER INCH / PER SIDE
- LONGER OVERALL LENGTHS ACCEPTABLE BY APPROVAL
- ORIENTATION OF KEY TO BE LOCATED AT 0° WHENEVER POSSIBLE
- ETCHED WITH PUNCH DIMENSIONS
- MADE OF M2 OR EQUIVALENT
- HOLE SIZE BASED ON MATERIAL CLEARANCE

Format B mm	Scale 2:1		Master Data 2D/3D		General Tolerances SEE NOTE		Rev. B		
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Customer Reference Name/No. MARWOOD			Colour ---		Surf. prot. ---		Author	7/17/2019	IDOUDIN
							Checked	7/17/2019	---
							Approved 1	7/17/2019	JLINDSAY
					Approved 2		7/17/2019	---	
 MARWOOD			Title					Type	
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			Drawing No. STANDARD_NOTCH_BUTTON_SMALL					Sheet 1 of 1	
WHEN PROCURED FROM EXTERNAL SOURCES: Delivery only in accordance with drawing and/or CAD-Data and tested and approved sample. No change without advance approval by the drawing/CAD-data identified with the modification note by Marwood.						CONFIDENTIAL ALL RIGHTS RESERVED. Distribution or copies without written agreement by Marwood is prohibited.			

Standard Imperial Notch Buttons and Punches

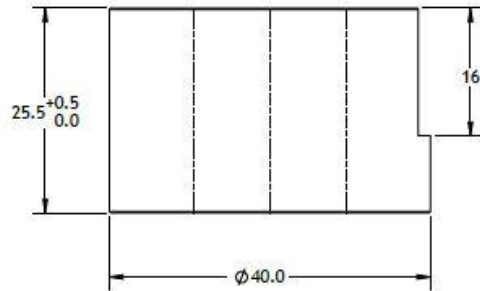
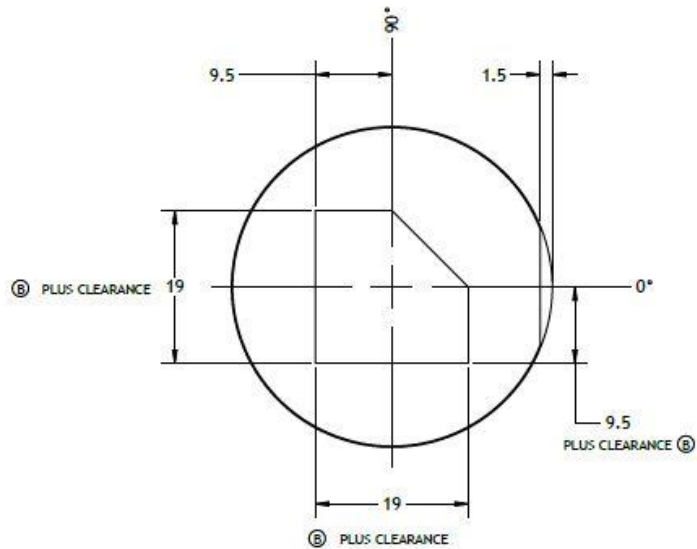
REVISIONS		
REV.	DESCRIPTION	DATE
A	INITIAL RELEASE	6/7/2019
B	BALL LOCK LOCATION NOTE	7/17/2019

ALL PUNCHES TO BE:

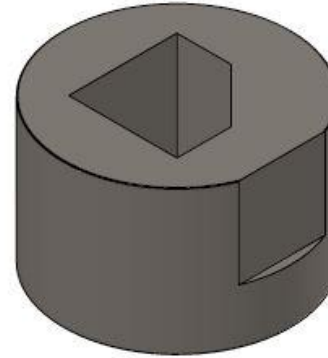
- HEAVY DUTY BALL LOCK AND EJECTORS
- ETCHED WITH PUNCH DIMENSIONS
- BALL LOCK LOCATION STANDARD AT 0°
- OVERALL LENGTH IS STANDARD UNLESS REVIEWED AND APPROVED BY MARWOOD
- HEEL ADDED TO BACK SIDE OF PUNCH 3/16 WIDE 1/4 HIGH

Format B	Scale 2:1		Master Date 2D/3D	General Tolerances SEE NOTE	Rev. B															
Related Documents			Material (Final Condition) M2		System SOLIDWORKS Professional 2018 <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Author</th> <th>Date</th> <th>Name</th> </tr> </thead> <tbody> <tr> <td>---</td> <td>7/17/2019</td> <td>IDOUIN</td> </tr> <tr> <td>---</td> <td>7/17/2019</td> <td>---</td> </tr> <tr> <td>Approved 1</td> <td>7/17/2019</td> <td>JLINDSAY</td> </tr> <tr> <td>Approved 2</td> <td>7/17/2019</td> <td>---</td> </tr> </tbody> </table>	Author	Date	Name	---	7/17/2019	IDOUIN	---	7/17/2019	---	Approved 1	7/17/2019	JLINDSAY	Approved 2	7/17/2019	---
Author	Date	Name																		
---	7/17/2019	IDOUIN																		
---	7/17/2019	---																		
Approved 1	7/17/2019	JLINDSAY																		
Approved 2	7/17/2019	---																		
Customer Reference Name/No. MARWOOD			Colour ---	Surf. prot. ---																
			Title STANDARD NOTCH PUNCH SMALL																	
			Drawing No. STANDARD_NOTCH_PUNCH_SMALL																	
WHEN PROCURED FROM EXTERNAL SOURCES: Delivery only in accordance with drawing and/or CAD-data and tested and approved sample. No change without advance approval by the drawing/CAD-data identified with the modification note by Marwood.				CONFIDENTIAL! ALL RIGHTS RESERVED. Distribution or copies without written agreement by Marwood is prohibited.																

Standard Metric Notch Buttons and Punches



REVISIONS		
REV.	DESCRIPTION	DATE
A	INITIAL RELEASE	6/7/2019
B	PLUS CLEARANCE	7/17/2019

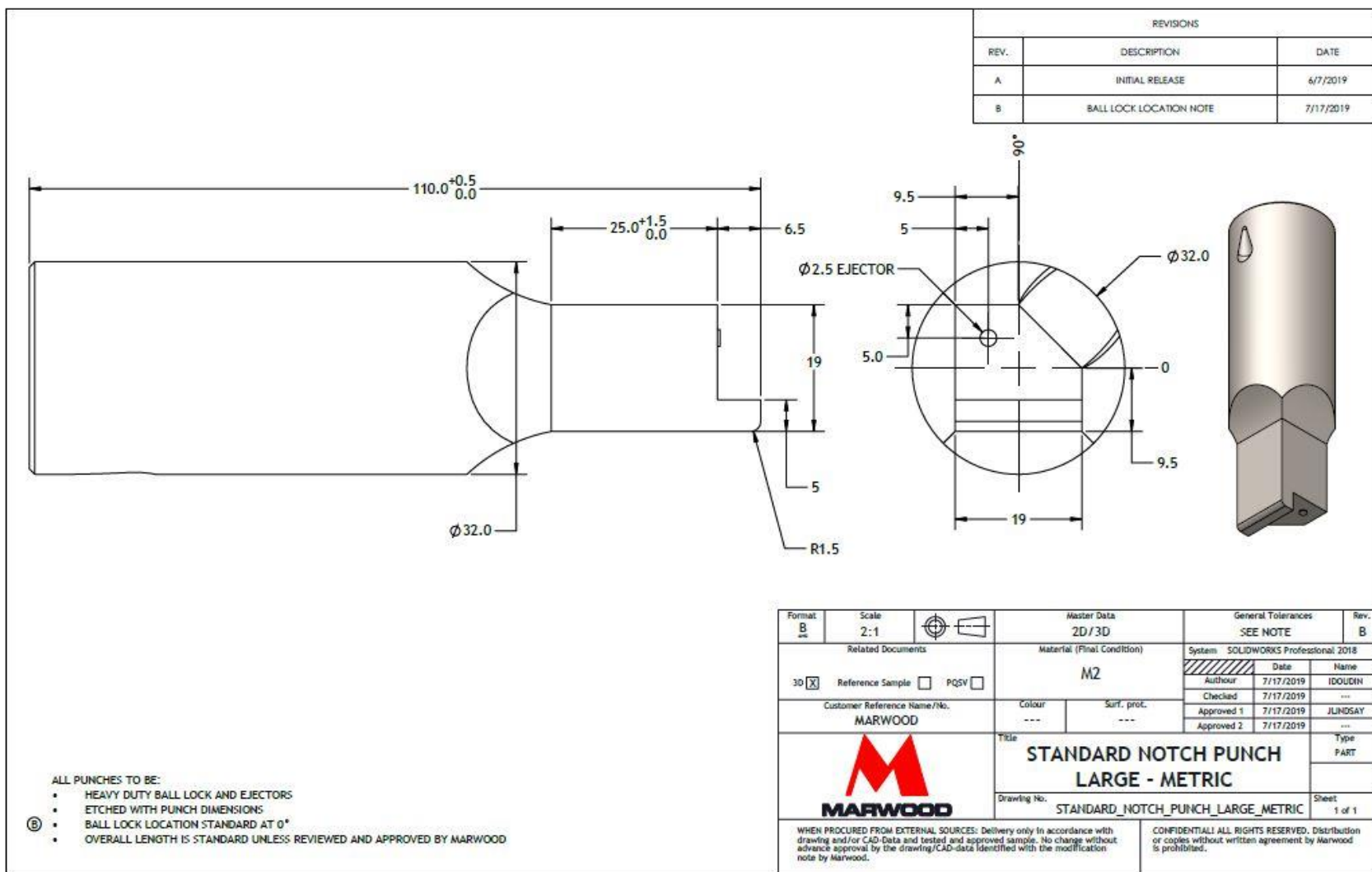


ALL DIES TO BE:

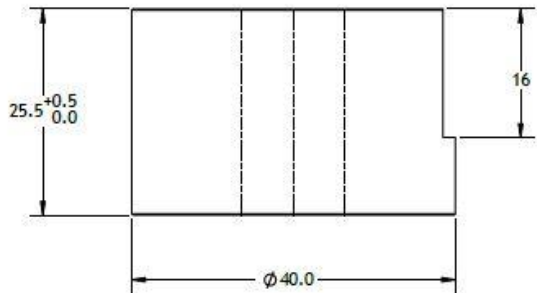
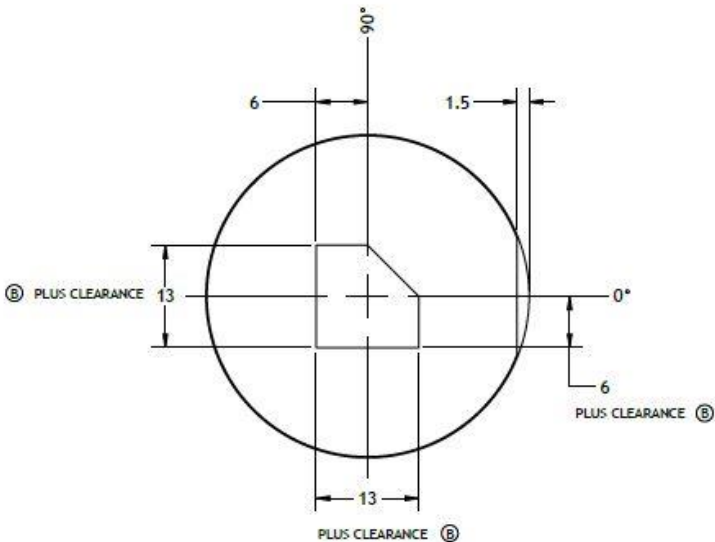
- TAPER RELIEF .006 / PER INCH / PER SIDE
- LONGER OVERALL LENGTHS ACCEPTABLE BY APPROVAL
- ORIENTATION OF KEY TO BE LOCATED AT 0° WHENEVER POSSIBLE
- ETCHED WITH PUNCH DIMENSIONS
- MADE OF M2 OR EQUIVALENT
- HOLE SIZE BASED ON MATERIAL CLEARANCE

Format B and	Scale 2:1		Master Data 2D/3D		General Tolerances SEE NOTE		Rev B	
Related Documents			Material (Final Condition) M2 OR EQUIVALENT		System SOLIDWORKS Professional 2018			
3D ☒ Reference Sample ☐ PQSV ☐			Colour --- Surf. prot. ---			Date 7/17/2019	Name IDOUEN	
Customer Reference Name/No. MARWOOD					Author ---	Checked 7/17/2019	Approved 1 7/17/2019	Approved 2 7/17/2019
 MARWOOD			Title STANDARD NOTCH BUTTON LARGE - METRIC		Type PART			
			Drawing No. STANDARD_NOTCH_BUTTON_LARGE_METRIC		Sheet 1 of 1			
WHEN PROCURED FROM EXTERNAL SOURCES: Delivery only in accordance with drawing and/or CAD-data and tested and approved sample. No change without advance approval by the drawing/CAD-data identified with the modification note by Marwood.					CONFIDENTIAL ALL RIGHTS RESERVED. Distribution or copies without written agreement by Marwood is prohibited.			

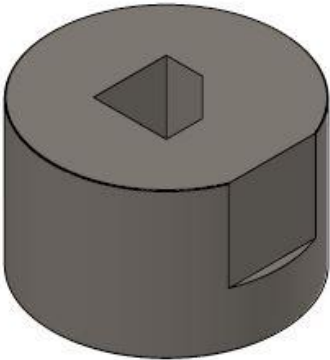
Standard Metric Notch Buttons and Punches



Standard Metric Notch Buttons and Punches



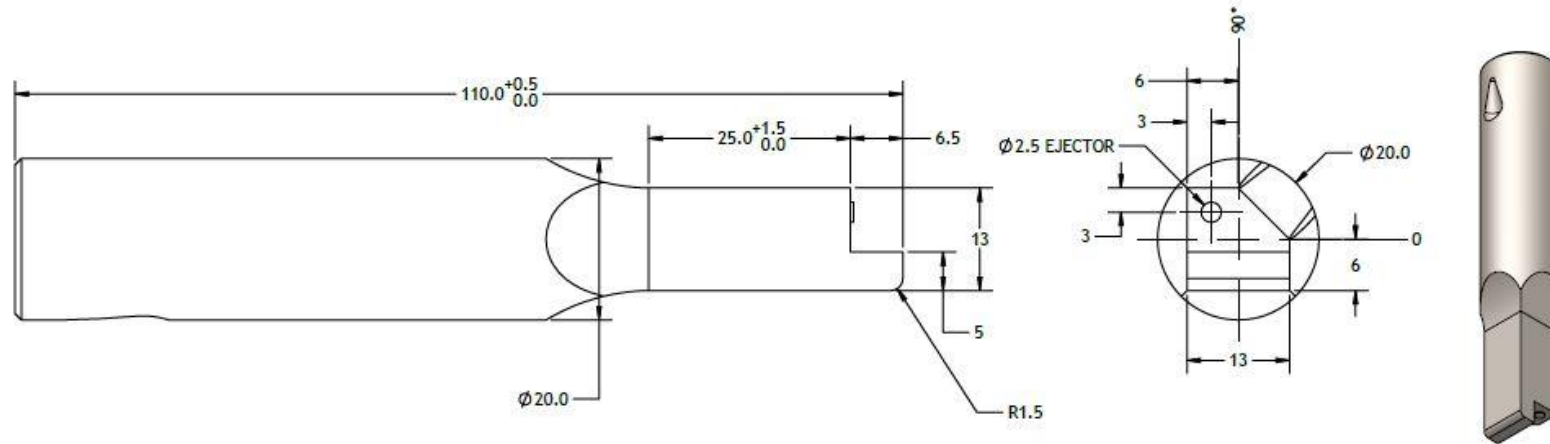
REVISIONS		
REV.	DESCRIPTION	DATE
A	INITIAL RELEASE	6/7/2019
B	PLUS CLEARANCE	7/17/2019



- ALL DIES TO BE:
- TAPER RELIEF .006 / PER INCH / PER SIDE
 - LONGER OVERALL LENGTHS ACCEPTABLE BY APPROVAL
 - ORIENTATION OF KEY TO BE LOCATED AT 0° WHENEVER POSSIBLE
 - ETCHED WITH PUNCH DIMENSIONS
 - MADE OF M2 OR EQUIVALENT
 - HOLE SIZE BASED ON MATERIAL CLEARANCE

Format B	Scale 2:1		Master Data 2D/3D	General Tolerances SEE NOTE	Rev. B
Related Documents		Material (Final Condition) M2 OR EQUIVALENT		System SOLIDWORKS Professional 2018	
3D ☒ Reference Sample ☐ PQSV ☐		Colour --- Surf. prot. ---		Author 7/17/2019	Name IDOUIN
Customer Reference Name/No. MARWOOD		Title STANDARD NOTCH BUTTON SMALL - METRIC		Checked 7/17/2019	---
		Drawing No. STANDARD_NOTCH_BUTTON_SMALL_METRIC		Approved 1 7/17/2019	JLHDSAY
WHEN PROCURED FROM EXTERNAL SOURCES: Delivery only in accordance with drawing and/or CAD-Data and tested and approved sample. No change without advance approval by the drawing/CAD-data identified with the modification note by Marwood.		CONFIDENTIAL! ALL RIGHTS RESERVED. Distribution or copies without written agreement by Marwood is prohibited.		Approved 2 7/17/2019	---
				Type PART	Sheet 1 of 1

Standard Metric Notch Buttons and Punches



REVISIONS		
REV.	DESCRIPTION	DATE
A	INITIAL RELEASE	6/7/2019
B	BALL LOCK LOCATION NOTE	7/17/2019

Format A4	Scale 2:1		Master Data 2D/3D		General Tolerances SEE NOTE	
Related Documents			Material (Final Condition)		System: SOLIDWORKS Professional 2018	
3D ☒	Reference Sample ☐	PQSV ☐	M2			Date
Customer Reference Name/No. MARWOOD			Colour ---	Surf. prot. ---	Author	7/17/2019
					Checked	7/17/2019
					Approved 1	7/17/2019
					Approved 2	7/17/2019
 MARWOOD			Title STANDARD NOTCH PUNCH SMALL - METRIC		Type	
					PART	
					Sheet	
			Drawing No.		1 of 1	
			STANDARD_NOTCH_PUNCH_SMALL_METRIC			
WHEN PROCURED FROM EXTERNAL SOURCES: Delivery only in accordance with drawing and/or CAD-Data and tested and approved sample. No change without advance approval by the drawing/CAD-data identified with the modification note by Marwood.					CONFIDENTIAL! ALL RIGHTS RESERVED. Distribution or copies without written agreement by Marwood is prohibited.	

ALL PUNCHES TO BE:

- HEAVY DUTY BALL LOCK AND EJECTORS
- ETCHED WITH PUNCH DIMENSIONS
- BALL LOCK LOCATION STANDARD AT 0°
- OVERALL LENGTH IS STANDARD UNLESS REVIEWED AND APPROVED BY MARWOOD
- HEEL ADDED TO BACK SIDE OF PUNCH 3/16 WIDE 1/4 HIGH

10.1: Drawing Details

The location of all parallels and die sections must be identified on a drawing. A copy of this drawing shall be submitted to and remain on file at Marwood.

10.2: On the Die Set

- The location of all fixed sections must be identified on the shoe.
- All die shoes must be stamped with 3/8" characters indicating the latest engineering information that the tool was built to or changed to and must include:
 - Part name
 - Part number (Marwood part number must also be displayed on upper die shoe)
 - Nominal material gauge, width and progression
 - Operation number (where applicable)
 - Tool source
 - Shut height (must include parallels)
 - Weight of upper die shoe (must also be displayed on upper die shoe in pounds and kilos)
 - Total weight of die (upper and lower die shoe combined, must be displayed on lower die shoe) must be displayed in pounds and kilo)
- Upper die shoe must identify with MAG where upper MAG plate will be used.

10.3: Paint

All die shoes must be painted (see Table 12) as specified on the purchase order

10.4: Marwood ID Tag

Every die must have a Marwood ID tag (see Figure 25), which is attached directly to the die. It is important that these tags be stamped with the correct information. The tags must be riveted as fastening with screws will no longer be accepted. These tags will be supplied by Marwood as requested. All tools must have provisions for tag attachment, final location to be discussed at design review.

(Suggestion ... Change Asset tag so we can see the numbers better.)

Table 12: OEM Die Colour

OEM	Tremclad Colour
Subaru	Orange
Toyota/Toyotetsu/ Hino / Takumi	White
GM	Red
FCA	Light Blue
Rivian	Yellow

Figure 25: Marwood ID Tag



Part #

Property of

Tool Source

Country of Mfg.

Drawing #

Date Modified

11.1: Payment Terms

A Purchase Order will be generated by the Tooling Specialist and sent electronically to the Vendor unless arranged otherwise. Payment terms shall be stated on the Purchase Order.

All tool timing must be met as specified on Marwood Tooling Purchase Order. Failure to meet the specified dates may initiate a Supplier Non Conformance Report (SNCR) from Marwood to the vendor. This SNCR may include any monetary costs and penalties incurred by Marwood plus an administration fee. For more information about the SNCR process, please download the Supplier Requirements Manual from our website.

All attempts will be made to keep purchase orders up to date in order to reflect engineering changes and new timing as specified in Vendor quotations or agreed upon with the Tooling Specialist and Sales.

11.2: Buy Off

No buy-off will take place without die Vendor / Tooling Specialist present and supervising the complete running of the die. Die vendor / Tooling Specialist is 100% responsible for all activities during the buy-off until a signed buy-off sheet is completed. Upon Buy Off, a complete listing of perishable spares will be determined and documented. Any unique or non-purchased items will be identified and quoted to Marwood Engineering.

All Die Designs, material lists, wire paths, Cad Data and Bill of Materials are property of Marwood International

11.3: Responsibilities

When a Vendor is shipping product(s) to Marwood International, the Vendor will include:

- Packing Slip
- Bill of Lading
- Last off part and/or strip
- Check Fixture
- Banding and Tarping as required
- Customs Documentation as required

Please be advised that Marwood Shipping, or its designated carriers, will **ONLY** pick up items that are detailed on the internal Marwood Shipping Memo. This document is created by your Marwood contact after discussions on availability and timing.

In the event that any other items must be shipped, please contact the Marwood Tooling Specialist to co-ordinate shipping. Do not impose upon the truck drivers unless you have written permission from the Marwood Shipping Department.

11.4: Packing Slip

Please be advised that all tool shop samples and prototype parts must be shipped with a packing slip. This packing slip must contain the information outline on the next slide (**see Table 13**).

Table 13: Packing Slip Contents

Item	Description
Part Number	This will be the part number identified on the purchase order supplied by Marwood Metal. Or, call your Marwood contact for the appropriate part number.
Part Name	This will be the part name as identified on the Marwood supplied purchase order. The part name must contain the 'R' or 'L' for symmetrically opposite parts. Or, call your Marwood contact for the appropriate part name.
Engineering Change Level	This will be the engineering level as identified on the Marwood supplied purchase order. Or, call your Marwood contact for the appropriate engineering change level.
Quantity	The amount per container must be identified (For inventory purposes the quantity parts being shipped must be exact)
Date	Date the package was shipped

It is important to complete a packing slip for each container when shipping several containers of the same part.

11.5: NAFTA

Marwood supplies stampings and assemblies in the international market. Due to the NAFTA regulations we find it necessary to ask all Vendors to complete a Certificate of Origin (B 232E), for each set of tools built for and supplied to Marwood. This document must be filled out by the shipper, or designate, and must be signed by Senior Management.

Cells 3, 5, 9, 10, and 11 must be completed, along with the signatures required in the lower portion. If necessary, a Marwood representative may aid the Vendor in the completion of this form.

11.6: Packaging

All dies must be blocked with wood and banded together before shipment. For overseas shipments, use two steel retention bars bolted to die lift holes (upper to lower shoe).

12.0: LIST OF MARWOOD CONTROLLED DOCUMENTS

Table 15: List of Marwood Controlled Documents

Form Number	Title	Revision
<u>F0019</u>	Stamping Process Planning Sheet	17-Feb-09
<u>F0025-T</u>	Request for Tool Quotation	14-Nov-07
<u>F0030</u>	Stamping Process Inspection Sheet	06-Jul-09
<u>F0081</u>	Tooling Design Inspection Sheet	06-Jul-09
<u>F0220</u>	Tooling Supplier Information	02-Jan-08
<u>F0295</u>	Die Design Deviation Request	15-Dec-09
<u>(Electronic)</u>	Marwood Purchase Order (with description)	N/A
<u>*B232 E</u>	NAFTA	(online)

Please Contact Marwood Tooling Specialist for any assistance if required

* The NAFTA From has been provided for your reference only.

This document should be accessed directly through Revenue Canada

www.cbsa-asfc.gc.ca

- Select 'Publication and Forms' from the left-hand column
- Select 'Forms' from the center of the page
- Select form B232

Table 14: List of Marwood Drawings

Drawing Number	Title	Native File Format	Revision
<u>MMF DWG-01</u>	Floater Base Template	NX3	002
<u>MMF DWG-02</u>	Tool Centering Type A	NX5	004
<u>MMF DWG-03</u>	Type A 4-Way	NX5	002
<u>MMF DWG-04</u>	Type A 2-Way	NX5	004
<u>MMF DWG-05</u>	Tool Centering Type B&C	NX5	004
<u>MMF DWG-06</u>	Type B&C 4-Way	NX5	002
<u>MMF DWG-07</u>	Type B&C 2-Way	NX5	004
<u>MMF DWG-08</u>	Sensor Wiring Access	NX7.5	003
<u>MMF DWG-09</u>	Part/Scrap Chute Bracket	NX3	REL
<u>MMF DWG-10</u>	Short feed Sensor Latch Block	NX5	REL
<u>MMF DWG-11</u>	Paddle	NX5	REL
<u>MMF DWG-12</u>	Lever	NX5	REL
<u>MMF DWG-13</u>	Buckle Lever Block LH	NX5	REL
<u>MMF DWG-14</u>	Buckle Lever Block RH	NX5	REL
<u>MMF DWG-15</u>	Plate	NX5	REL
<u>MMF DWG-16</u>	Plunger	NX5	REL
<u>MMF DWG-17</u>	Buckle Plunger Block	NX5	REL
<u>MMF DWG-18</u>	Stripper Standoff (1.5in)	NX7.5	001
<u>MMF DWG-19</u>	Stripper Standoff (2.0in)	NX7.5	001

Copies of Marwood Standard Drawings Can be found on Sharefile

13.0: COMPONENT SUPPLIER CONTACT LIST

Components	Company	Tel, Fax & Web
All Die Components	Canadian IPG 12 Spackman Blvd. St. Thomas, ON N5P 4A3	Tel: 519-637-1945 866-612-1474 Fax: 519-637-9848 www.canadianpg.com
Nitrogen Systems	DADCO Canada 2530 Meadowpine Blvd. Mississauga, ON L5N 6C4	TEL: 905-567-9100 800-268-2064 Fax: 519-637-9848 www.dadco.net
	HYSON 3100 Mainway Burlington, On L7M 1A3	TEL: 905-331-1311 800-713-1575 FAX: 905-331-1342
Date Stamps	CAN-AM Machine & Tool 4010 Breck Avenue London, ON N6L 1B4	TEL: 519-652-6855 FAX: 905-331-1342
	BIRO Engraving Inc. 23 Tamara Place Brantford, ON N3P 1M8	TEL: 519-758-0679 www.biroengraving.com
Ready Benders	DAYTON PROGRESS CANADA 861 Rowntree Dairy Rd. Woodbridge, ON L4L 5W3	TEL: 905-264-2445 800-465-4944 FAX: 905-264-1071
	READY 333 Progress Rd. Dayton, OH 45449 Michigan Office:	TEL: 800-543-4355 FAX: 937-866-7226 TEL: 517-729-9054 FAX: 937-866-7226

Springs, Bushings and Die Sets	Anchor Danly 311 Pinebush Road Cambridge, ON N1T 1B2	TEL: 519-740-3060 800-265-7842 FAX: 519-740-8213 www.anchordanly.com
	MISUMI USA, Inc 1105 Remington Road, Suite B Schaumburg, IL 60173	TEL: 847-843-9105 800-681-7475 FAX: 847-843-9107 800-681-7402 www.misumiusa.com
Die Buttons for Clinch Nuts	MISUMI Group Inc 2-4-43 Toyo, Koto-ku, Tokyo 135-8458, Japan	TEL: (81) 3-3647-7116 FAX: (81) 3-3647-7125 www.misumi.co.jp/en
	Multifastener 22100 Trolley Industrial Dr. Taylor, MI 48180-1872	TEL: (81) 3-3647-7116 FAX: (81) 3-3647-7125 www.multifastener.com
Punches and Buttons	IMPAX Tooling Solutions 12912 Farnham Avenue White Bear Lake, MN 55110	TEL: 800-944-4671 FAX: 800-944-4679 www.wilsontool.com
	Moeller Manufacturing 43938 Plymouth Oaks Blvd. Plymouth, MI 48170-2584	TEL: 734-416-0000 FAX: 734-416-2220
	Porter Precision Products 45 Durward Pl. Waterloo, ON N2L 4E5	TEL: 519-746-3130 FAX: 519-746-6960 www.porterpunch.com